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Plate Glass Manufacture by the Continuous Process

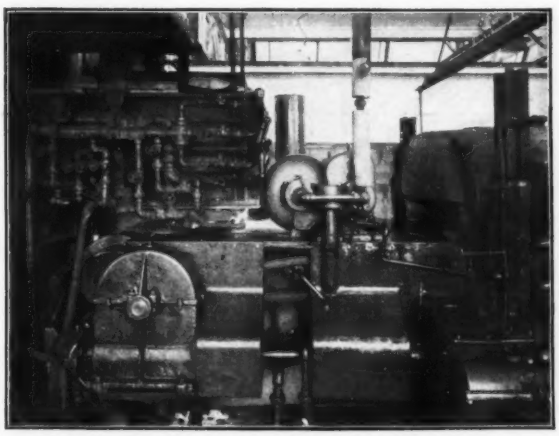
[The author of this paper, which appears in the Transactions of the American Society of Mechanical Engineers, Materials Handling Division (Vol. 51—No. 19), was actively engaged for several years in an executive capacity in the development at the Ford Motor Company's plant in Detroit of the first successful and revolutionary method of making plate glass by a continuous method. —EDITOR.]

By C. W. AVERY [1]

Troubles encountered in the development of the continuous process of plate glass manufacture are discussed in this paper. Materials used had to be perfected, and an absolutely uniform gas pressure maintained. There were many problems in rolling, annealing, grinding, and polishing that were quite different from previous practice. Cooling of the rolls, and securing a material for them that would withstand the high temperature required considerable study. Much experimenting with the shape, weight, and speed of the various grinding wheels was necessary. After four or five years of intensive study and hard work, a good quality of plate glass was produced at about half the cost of production by old methods.

PLATE glass manufacture is an old industry, and up to a very few years ago very little progress had been made in handling methods. The materials, which consist chiefly of silica sand, soda ash, and limestone, are mixed and placed in large clay pots. These pots are then placed in large furnaces where the melting process is started. The temperature in these furnaces is carried through the first eighteen hours at about 2600 deg. fahr. It is then reduced over a period of 5 or 6 hr. through what is called the fining process. The pots are then removed by overhead cranes and transported, frequently over a considerable distance, to the casting table, which is a large cast iron surface plate with water-cooling provision. At one end of this plate rests a large cast iron roll. After skimming the glass, and thoroughly cleaning the pots all over to prevent any particles of dirt from falling upon the table, the glass is poured from the pot in front of the large roll, which is then passed over it, rolling the plastic mass into a rectangular sheet ½ in. to ⅝ in. thick, 10 ft. to 12 ft. wide and 14 ft. to 20 ft. long. As soon as the glass has set sufficiently to retain its shape, it is pushed from the table into the first annealing furnace where it is held for a few minutes at 1200 deg. fahr. It is then pushed successively, each time at right angles, through succeeding annealing furnaces, gradually reducing its heat to 150 or 200 deg.

It has then been properly annealed and is ready for the grinding tables. These grinding tables are large, round cast iron tables, weighing with the glass mounted on them from 15 to 20 tons. The rough plate, as it is called after it is taken from the annealing furnaces, is seldom mounted on the grinding table in its original size. Defects must be removed. The glass is then mounted in plaster of Paris on these tables, and transported to the nearest grinding machine. The table is pushed under the grinding head by mechanical means over a large vertical spindle. This spindle is then raised hydraulically until it lifts the table and its wheels free from the track. The spindle and table are then revolved, and



FORD MOTOR COMPANY EQUIPMENT ROLLING FLAT GLASS IN A CONTINUOUS "RIBBON"

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NOTE: Statements and opinions advanced in papers are to be understood as individual expressions of their authors, and not those of the Society.

the cast iron grinding disks lowered onto the glass. These disks are set off center with the table, and caused to revolve by the unequal friction. Successive grades of grinding sand are introduced as the process advances. When the surface of the glass has been ground flat with coarser sands, and smooth with the finer grades, all traces of sand are washed off, and successive grades of fine emery are introduced, finally leaving the glass as smooth as it is possible to make it before the polishing process. The table with the glass is

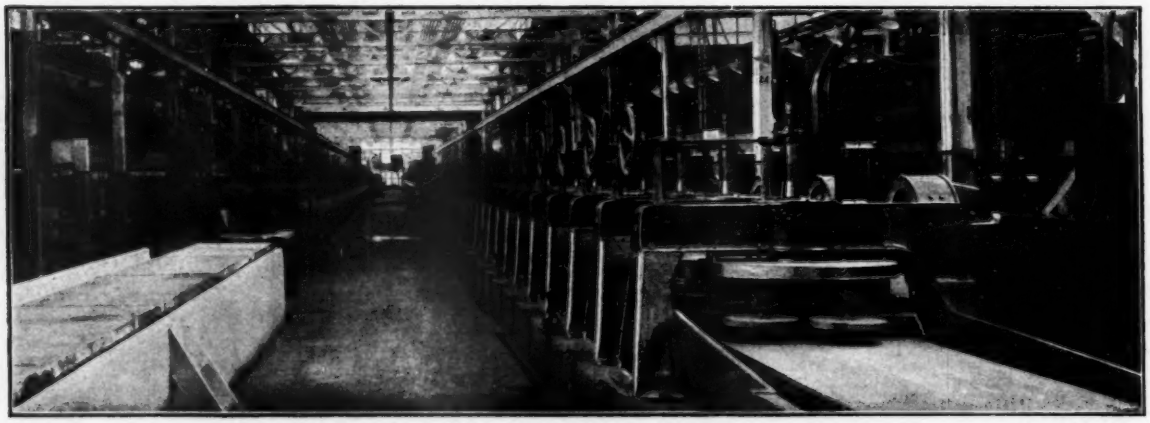
ANOTHER VIEW OF THE FORD CONTINUOUS PROCESS EQUIPMENT

then removed from the grinding machine, and moved by mechanical means to another portion of the factory where the surface is polished in much the same manner by the use of felt disks and rouge. The glass is then removed from the table and reversed. The other side is treated in the same way.

In the early days of automobile production, plate glass was used largely in store fronts, the desirable product being large sheets. The resulting small cuts were a drug on the market, and were sold at any price that could be obtained for them. The first automobiles were built without windshields and the closed car had never been heard of. Demand for automobile glass was so small that the small-sheet by-product of the plate glass industry could take care of it very satisfactorily. This accounts for the fact that windshield plate glass could be purchased in the early days of automobile manufacture for approximately 22 cents per square foot. However, as windshields became standard equipment on all cars, and the glass requirements for closed cars increased, it was necessary for large sheets to be cut into small ones to take care of the increasing requirement. The price of automobile glass increased from 22 cents to 90 cents, or more, and the increase in production was far less than the increase in demand.

In all process development simplicity is essential. It is easy to develop a complicated process, but to bring it to the highest form of simplicity requires real study. In five minutes nature moves 300 tons of water ¼ mile in a trout stream that you jump across a score of times in a day's fishing. A day's work of this stream would cost $175,000 with men and buckets, $25,000 with hand trucks, and $1200 with motor trucks.

About 1918 at the Ford Motor Company the idea was conceived of manufacturing plate glass by continuous methods similar to the methods then used in the automobile industry. The plan, in general, consisted in melting the glass in a continuous-tank furnace, with the batch entering at one end, and the molten glass running out of a spout directly into the rolling machine at the other end, then, in the form of a ribbon, passing through the various temperature zones of the annealing furnace (commonly called a lehr). It was then to be cut into convenient lengths, mounted on rectangular tables, and passed continuously under a series of grinding, smoothing, and polishing wheels. When the first side was finished the glass would then be reversed on the same tables and returned, under the second series of wheels, to the starting point, where the finished glass would be removed, and the tables be ready to make another round.



IN THE CONTINUOUS PROCESS, LONG BATTERIES OF GRINDING AND POLISHING MACHINES SMOOTH THE GLASS AS IT PASSES UNDER THEM ON THE CONTINUOUSLY MOVING CONVEYOR

This process seemed so simple when first started that no one realized the troubles that would be encountered in its development. It was thought that it would be a comparatively simple matter to use the standard window glass continuous tank furnace in the plate glass production. Window glass, of course, is not ground and polished, and therefore does not require the degree of perfection in the molten metal as does the plate glass. It was found necessary

to rebuild the first furnace several times before arriving at the right proportions for governing the heat in the various zones. Figures would indicate that a furnace holding 400 tons of molten glass, and delivering 20 tons every 24 hours would require 20 days in which to deliver the glass to the rolling machine. It was found, however, that much of the glass in the furnace never moved, and tests with coloring matter showed that some of the glass passed through the furnace within 36 hours. This was due to the more liquid state of the higher temperature glass on the surface. In

CONTINUOUS GLASS GRINDING AND POLISHING MACHINES PARTLY ASSEMBLED

making plate glass by the old pot method a variation in the materials from one pot to the other as high as 10 per cent was not serious. In the tank furnace, however, a portion of today's batch would probably come through tomorrow with a portion of last week's batch. If these two batches varied in chemical composition, there would be several different kinds of glass in the same sheet each with a different coefficient of expansion. This resulted in exceedingly high breakage, both in the annealing furnace, and under the grinding and polishing wheels, especially the latter. It was, therefore, necessary to bring a chemist into the picture, and impose a most rigid specification and inspection on incoming materials. Originally it was planned to use sand from a nearby source of supply. It was known that this sand contained a percentage of limestone, but it was thought that, inasmuch as limestone is used in the mixture, it would do no harm to introduce part of it with the sand. The lime content of the sand, however, was found to vary from 2 per cent to 6 per cent, and it was necessary to adopt a sand which was 99 per cent pure silica. Troubles in the mixture of glass coming from furnaces were not over when the material was perfected. It was found necessary to have an absolutely uniform glass pressure, and also to have a gas of uniform British thermal unit value. When these elements had all been corrected, the problems in the melting end were practically all solved.

These problems would have been much simpler had they not been superimposed upon the problems of rolling, annealing, grinding, and polishing at the same time. The first development in a rolling machine was intended to duplicate the flat table of the old process as nearly as possible. A chain conveyor made up of closely fitting platens was passed under a mechanically driven roll, and the glass drawn from the spout in the furnace onto this platen conveyor. Here again the problem of simplicity was involved. The first attempt was too complicated, and caused too much trouble. The double-roll machine was then developed which consisted of a small roll mounted slightly forward of, and above the large roll on which the glass poured from the furnace. Certain problems in cooling these rolls then appeared. The surface of the large roll where the glass first came in contact

THE GLASS IS MOUNTED IN PLASTER OF PARIS ON TABLES FOR GRINDING AND POLISHING

with it would become much hotter than the edges. A water-circulating system through the shaft, and distribution according to heat requirements finally solved this problem. It was necessary to preheat the water to a certain temperature to avoid chilling the glass immediately in contact with the roll, which was found to cause surface cracks.

The continuous lehr had been used in connection with production of window glass. Here again the requirements were different. The initial temperature required in the window glass lehr was very much lower than that of the

plate glass lehr, and here the greatest problem lay in securing the proper material for the rolls to withstand the higher temperature. This was finally acomplished by using tubular steel rolls, air cooled to the highest temperature they would stand continuously without distortion. The first lehrs that were built were heated with gas burners, and the temperature in the different zones was manually controlled. Later, automatic controls were introduced, and still later the electric lehr was developed. In the development of the electric lehr, the principle was used that the glass entering a lehr contained enough heat to anneal itself, providing the dissipation of that heat were controlled properly. The furnace was heavily insulated, and electric heating elements under automatic control maintained the exact temperature required. This furnace has given most excellent annealing results. The first glass was made in a ribbon 20 in. wide but at an early stage was increased to 40 in. In the last few years, however, the development of the continuous process has increased the width of sheets to 8 ft. or 10 ft.

In the first efforts in grinding glass sufficient attention was not given to the mechanical accuracy of the equipment. The track was laid approximately level. The tables were made with ordinary spindle bearings. It was found that the utmost accuracy and rigidity of these grinding tables were absolutely necessary. Foundations were strengthened, and the track leveled to absolute accuracy within three or four thousandths of an inch. Wheels were made with hardened steel tires, and mounted on adjustable taper-roller bearings in order that the centers might be maintained accurately.

Much experimenting with the shape, weight, and speed of the various grinding wheels was necessary. A continuous flotation system for grinding sand had to be developed. All the grades of sand fell from the tables into the gutters underneath, and were washed together into a collecting basin, and pumped to the flotation tanks overhead. These tanks were built of such a size that the velocity through them would deposit in each its particular grade of sand. The problems in finding a simple method of drawing this sand continuously from the bottom of each tank were many. The tanks were spaced at intervals so that each grade of sand moved through the shortest distance possible to its required location on the grinding wheels. Approximately the same development was applied to the smoothing wheels where different grades of fine emery were used for abrasive. In the old method of polishing glass the rouge was first introduced under the felt wheels with a high percentage of water. As the water evaporated the rouge became more and more effective with a gradual increase in the temperature of the glass. When the glass was finally polished the dry rouge could be washed off the felts, which left them in the proper condition for the succeeding operation. In the continuous operation each polishing head remained under the same condition 24 hours a day, and the problems of dry and caked rouge on the felts in the final stages were rather serious. They were solved, however, by determining the exact specific gravity requirements of the rouge used, and by the introduction of surplus polishing heads so that ocasionally a head could be lifted, and the felts cleaned.

The problems cited in the entire project were the major ones only. There were thousands of minor problems, sometimes rather confusing, due to the fact that several of them would appear at the same time. After four or five years, however, of intensive study and hard work, a good quality of plate glass was produced by the continuous process at approximately half the cost of production by the old methods.

This is simply an illustration of the application of continuous methods of manufacture to an industry other than the automobile industry. The necessary requirements for this application are, (1) sufficient volume of production, and (2) a serious scientific study of the problem in hand.

Abrasives for Glass

By F. W. PRESTON [1]

THE glass industry uses considerable quantities of abrasives, sand, silicon carbide, aluminous abrasives including emery, garnet, and others, not excepting diamond. We may include rouge (ferric oxide) in the same category. Of sand alone it is probable that half a million tons or more are used in this country each year for grinding purposes, yet the action of abrasives is still very obscure, and comparatively little progress has been made in their application to this industry. Such work as has been done is often very conflicting and uncertain in its conclusions.

It would seem that two fundamental types of abrasion ought to be considered, as a theoretical foundation on which to establish general principles. Actual abrasives may approximate quite closely to one or the other of these, but in general will lie somewhere between the two.

The two theoretical types would be, abrasion with perfectly blunt (spherical) abrasives, and abrasion with perfectly sharp abrasives. The laws governing the connection between the rate of abrasion with the pressure used, the speed of travel, the size of abrasive, the amount of abrasive used, and so on, are quite different for the two types, and this makes the experimental investigation of the subject quite difficult. For it is not easy to control the sharpness of the abrasive over any great range of sizes; and since the abrasive breaks down, both its size and its sharpness pass from our control.

One may arrive at totally different "Laws of Abrasion," according as one experiments with, say, the natural sands of Illinois, or the artificial abrasives of New York or Massachusetts.

The use of spherical abrasives is exemplified in the cutting of granite with chilled shot. Many of these machines are so arranged that they deliver a series of blows upon the abrasive, and so gradually pound a way through the stone. They seem to use shock tactics. But the purpose of the periodical raising of the blade is mainly to let the shot get directly under it, and not to one side, as this results in the cut going

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out of plumb. The combination of suddenly applied shock upon the grains, and the rolling of them back and forth, cuts the hardest stone in a remarkable manner.

The polishing of glass with rouge seems also, to judge by the microscopic evidence of the worked surface, to be a case of grinding with spherical abrasives.

Most natural sands are so blunt as to be, in effect, spherical abrasives. When fed to a glass grinding machine the grains possess zero cutting power at the pressures used. However, grains of sand are so fragile that they forthwith crush down into smaller, but sharper fragments, and these fragments possess very appreciable cutting power. As the fragments are ground still smaller, their cutting power falls off. In experiments designed to test this point, we get some such curve as in Fig. 1, where it is shown how the rate of abrasion (amount of glass removed per minute) is zero at the start, rises to a maximum as the grains begin to crush down, and slowly falls away.

To remove one pound of glass by these tactics usually requires four or five pounds of sand to be ground to powder, and this in spite of the fact that sand, pure silica, is much harder than commercial glass. On massive quartz (pure silica in massive form) silica sand makes very little impression, but is itself remorselessly ground down. However it can do a little abrading, showing that Moh's scale of hardness has no strictly logical basis; for he defines one material as harder than another if it will scratch it. But here we have materials of the same hardness, and physically identical, scratching one another. Under some conditions a soft glass will scratch a harder one, so far as that goes; and of course

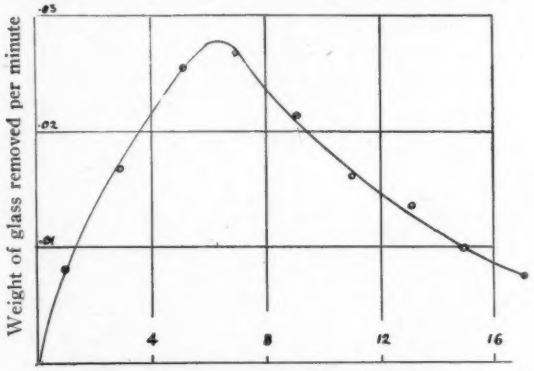


FIG. 1. TEST OF SLOW MOTION GRINDING MACHINE USING ROCK SAND (ORIGINALLY 30-50 MESH)

"diamond cuts diamond," but as Tolkowski has shown, that depends on the fact that there is a sort of grain in the surface of diamond, so that one can abrade it by rubbing in one direction and not by rubbing in another.

To return to the sand; ordinary commercial sands are not of uniform size; a typical grading of a Pennsylvanian sand is shown in Fig. 2. There is a certain amount of fine blunt material which in the grading process gets mixed with the crushed, and therefore sharp, fine material. There is good reason to suspect that the two are not strictly compatible, and this may be one of the reasons why it is somewhat difficult to get a truly even sand-smooth, free from "shiners," "crushmarks," or troublesome "under-grey."

Probably a worse difficulty is the rapidity with which the sand crushes down, so that one never really gets control of the working conditions. Mr. J. W. Cruikshank, formerly of Pittsburgh, once described the ordinary glass-grinding machine as "essentially a device for crushing sand." Judging by the size of some spoil-heaps, or by the turbidity of the Allegheny River below some glass plants, it might be reckoned a very effective machine for that purpose.

The optical and spectacle industries, which at one time used sand in some quantity, seem to have changed over completely to artificial abrasives. There is no evidence that such a development is in sight for the plate glass industry, where, on account of the cost, attempts are continually being

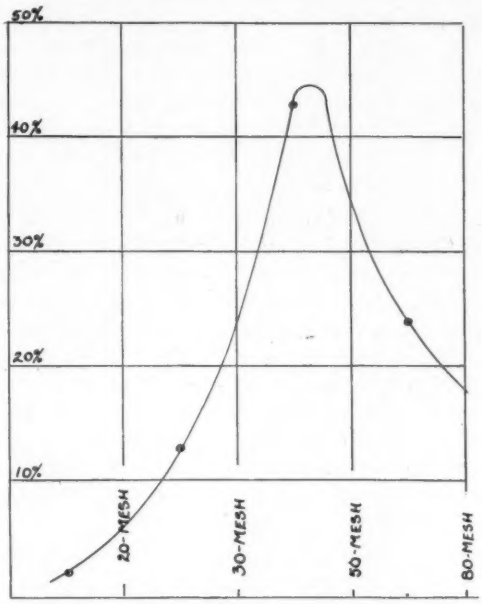


FIG. 2. TYPICAL GRADING ANALYSIS OF A WEST PENNSYLVANIAN ROCK SAND

made, generally with no permanent success, to eliminate even the natural abrasives other than sand (e.g., the emery or garnet) which are commonly used to finish the smoothing.

Artificial abrasives are available that produce a better smooth in less time and with a less weight of abrasive used, than any of the natural materials, but their cost is somewhat higher.

The structure of a ground glass surface is very complex, and cannot be made out by ordinary microscopic examination. The fissures made by the crushing process, which grinding really is, extend considerably below the surface proper. In order to produce a perfect surface by the subsequent polishing, it is therefore necessary to do what would appear to be a quite excessive amount of polishing. If a process of grinding could be devised that would not shatter the underlying layers, an immense saving in the polishing operation could be effected.

It is noteworthy that the processes of abrading glass, both the grinding and polishing, have undergone no visible improvement in the last hundred years. The scale of operations is greater, the facilities for mechanical handling of both wares and abrasives has improved, but the process itself uses the same materials in the same way. There has also been very little advance in our understanding of the subject.

Economics of Producer Gas, Fuel Oil and Natural Gas Compared

(IN 5 PARTS)

by JOHN W. ROMIG, M. E.
Corning Glass Works

Part V.

(*Conclusion*)

Comparison, Discussion and Appendix with Formulae

IN the preceding parts combustion studies for producer gas, fuel oil and natural gas in a continuous glass tank have been developed on the basis of net heat delivered to and retained in the combustion chamber for overcoming losses and for melting raw materials. From the studies equivalent values of the fuels are developed. It was found that 9,080 B.T.U. per pound of coal as received and delivered to the producers were retained in the combustion chamber; this is equivalent to 18,160,000 B.T.U. per ton of coal. In the case of fuel oil 113,080 B.T.U. were retained per gallon and 766,000 B.T.U. were retained per 1,000 cu. ft. of natural gas.

With producer gas as the normal tank fuel the equivalents are worked out in quantities and fuel cost based upon a coal cost of $4.50 per net ton as received. By dividing the net heat from 1 ton of coal by the net heat from 1 gallon of fuel oil, the fuel oil equivalent is secured and in a like calculation the natural gas equivalent is determined. Carrying out the arithmetic for the chosen fuels, we have: One ton coal is equivalent to 161 gallons of fuel oil and is equivalent to 23,600 cubic feet of natural gas.

The equivalent price of fuel oil to replace $4.50 coal is $4.50 divided by 161 or $.028 per gallon of fuel oil and the equivalent price of natural gas is $4.50 dividend by 236 or $.19 per thousand cubic feet. In other words, on the basis of fuel costs only with coal at $4.50 per net ton delivered, fuel oil cost delivered shall not exceed $.028 per gallon and natural gas shall not exceed $.19 per 1,000 cubic feet delivered. However, other items enter into the cost. More steam is required for producer gas than for fuel oil and no steam is required for natural gas.

The steam requirements for producer gas are 0.4 pounds of steam per pound of coal or 800 pounds per ton of coal. If the unit cost of steam is $.30 per thousand pounds the cost of steam is $.24 per ton of coal. Adding the steam cost to the coal cost a total cost of $4.74 per ton of coal is secured. Water cost will probably add another $.05 per ton of coal. The total fuel, steam and water cost with producer gas amounts to $4.80 per ton of coal.

Fuel oil requires 0.3 pounds of steam per pound of oil, 2.11 pounds per gallon or for the 161 gallon equivalent a total of 340 pounds of steam worth at $.30 per thousand pounds $.10 per oil equivalent of 1 ton of coal. Subtracting from $4.80 the sum $.10 we have $4.70 as the equivalent coal cost and dividing by 161 the fuel oil equivalent, it is found that $.0292 per gallon is the highest permissible price at which fuel oil will compete with coal.

Natural gas does not need water or steam so with a steam, water and coal total cost of $4.80 per ton on the equivalent fuel basis natural gas is worth $.203 per thousand cubic feet of 1000 B.T.U. gas of the analysis investigated under Part IV.

Summarizing the fuel equivalents and equivalent fuel prices for fuels as analyzed:

Fuel Value:

One ton coal is equivalent to 161 gallons fuel oil—is equivalent to 23,600 cubic feet natural gas.

And coal at $4.50 per net ton is equivalent to $.0292 per gallon fuel oil—is equivalent to $.203 per M cu. ft. natural gas.

In all of the above equivalent costs overhead charges, repairs, depreciation, taxes, insurance, labor, supervision, etc., are omitted as each glass tank and producer installation is different and no effort is made to assume a typical fuel system. In the case of producer gas fixed and labor changes will make a considerable increase in the cost of fuel gasified. Each plant has its own problems in proper determination of what fixed costs to include.

For instance, if tanks are being operated with producer gas and fuel oil is low in price a study of the economics is desirable. In this case producers will not be removed and fixed costs drop out or balance; however, additional investment for fuel oil equipment must be prorated and added. Repair costs to producers, producer labor, coal handling labor, ash handling labor and burn-out costs add to the cost of coal when gasified and must be balanced against labor and repair when using fuel oil.

As a matter of interest the calculations on a strict B.T.U. basis are presented. From Part I one pound of coal contains 14,300 B.T.U. as received. The total of chemical plus sensible heat in the producer gas cannot be credited—its value is uncertain because of checkerwork heat transfer efficiency and capacity. The fuel oil equivalent becomes 202 gallons while the natural gas equivalent becomes 28,600 cu. ft. Tabulated the results are:

HEAT EQUIVALENTS

Fuel	Selected basis of comparison	Straight B. T. U. basis	Per cent Greater on straight B. T. U. basis
Coal	1 ton	1 ton	....
Fuel Oil	161 gallons	202 gallons	24.0
Natural gas	23,600 cu. ft.	28,600 cu. ft.	21.0

It is evident from the table that on strict B.T.U. basis comparisons of fuels that the advantages of the fuel oil and fuel gas are not given the credit due them. If a producer gasification efficiency of 85 per cent is assumed, results by the two methods will compare more favorably.

Another interesting comparison in the results is the waste

gas analyses for each fuel with 50% excess air for producer gas and 30% for fuel oil and natural gas.

Constituent	% by Volume producer gas	Dry waste gas — % by Volume fuel oil	Dry waste gas — % by Volume
CO_2	13.8	11.8	9.0
O_2	5.2	5.2	5.2
N_2	81.0	83.0	85.8
Total	100	100	100

For proper combustion of natural gas in glass tanks some excess air must be supplied or combustible will pass out with the waste gases. Such combustible will not be analyzed as CO and only a complete analysis of the waste gas will show the amount of combustible lost. By allowing 50 per cent excess air for producer gas and 30 per cent excess air for fuel oil and natural gas the amounts of oxygen in the waste gases are almost equal. This allowance places the fuels on a more equitable basis than allowing the same percentage of excess air for each of the three fuels. Excess air in percentages therefore should be developed for a nearly constant percentage of O_2 in waste gases as it is the presence of the excess O_2 that keeps combustible out of the waste gases.

Besides actual cost there are other items to consider in a fuel. The most important are reliability, ease of regulation and quality of glass. Sometimes a better fuel may be justified because of glass quality; how much to allow for the intangible advantages is highly problematic—depending upon how seriously glass fuel troubles are affecting production.

By following the calculations of Part II for producer gas the merits of various gas coals may be determined and the economics of a higher or lower priced coal may be developed on a cost basis. Coals should not be compared on a strict B.T.U. basis but upon actual tests or calculations from data available.

It is necessary that all of the data used for calculations in comparing fuel economics are accurate. Errors in data will introduce errors in the final comparison almost in direct percentage in some cases, in others the final percentage error will be much less than the initial while in others the final error may be greater in percentage. Most important are fuel analyses, producer gas analyses, average tank inlet temperature of air, gas preheat and the average temperature of outgoing gases.

The calculations and examples presented in the various parts of this paper are offered as a method of comparing fuel economics when actual tests under constant operating conditions are not possible. If the calculated economics are favorable it is advisable to check them if a check may be made with a reasonable expenditure. However, it is known that if the data taken is accurate operating economics will closely check the calculated economics.

APPENDIX I

Thermal Energy Content of Gases.

Fundamental formula given herein are those selected by Goodenough and Felbeck in "An investigation of the maximum Temperatures and Pressures Attainable in the Combustion of Gaseous and Liquid Fuels." Bulletin No. 139 Eng. Exp. Sta. University of Illinois, 1923.

In each formula—

Let t = Actual temperature gas degrees F.

T = Absolute temperature of gas being investigated.

S = Sensible heat in 1 cu. ft. gas at actual temperature t above O F, at constant pressure of 30" mercury—B.T.U. per cubic foot.

Then:

For Ethylene C_2H_4

$S = X\ (6.67 \text{ plus } .0068\ T)$

For H_2, O_2, N_2 and Air

$S = X\ (6.00 + .0006667\ T)$

For CO_2

$S = X\ (7.15 \text{ plus } 3.90\ T \text{ minus } .0000006\ T^2)$

For H_2O vapor

$S = X\ (8.33 \text{ minus } .000276\ T \text{ plus } .000000423\ T^2)$

For CH_4

$S = X\ [3.46 \text{ plus } .0156\ T]$

Where $X = \frac{t}{380.6}$ in each formula.

Full Scale Experiment on Flow of Glass

A meeting of the London Section of the Society of Glass Technology was held on Wednesday March 5, 1930, at the Charlton works of The United Glass Bottle Manufacturers, Ltd., the chair being taken by Mr. T. C. Moorshead the company's technical director and general manager. A discussion on "The Flow of Glass in Tanks" was opened by Mr. A. Moorshead who described full scale experiments which had recently been carried out at the works with a tank having a capacity of 125 tons of glass, and also with small revolving pots into which glass is fed from the tank and from which the automatic bottle making machines draw their supply of glass. The experiments provided a means of locating any portions of the tanks in which the glass remained stagnant and also gave valuable indications of the directions of flow within the tanks. The results obtained were illustrated by large scale diagrams.

In response to a vote of thanks which was carried with acclamation, Mr. T. C. Moorshead said that free discussion of technical problems was of great value to the glass industry. His firm, The United Glass Bottle Manufacturers, Ltd., recognized this and were always happy to co-operate in any way they could with the Society of Glass Technology.

After the meeting, members were able to go around the works and examine the tank in which the experiments on flow had been carried out, and also to see the extensive bottle making plant in operation.

The February meeting of the London Section was held on Wednesday, February 5, at Holophane, Ltd., Elverton Street, Westminster, Mr. E. A. Coad-Pryor being in the chair. A discussion on "Refractory Tubing for Pyrometers" was opened by Mr. D. Dixon who exhibited a large number of samples in illustration of his remarks.

Mr. F. F. W. Flaig next gave an account of "The Manufacture and Testing of Glass Stopcocks." He exhibited a large variety of different types of stopcock, made in Great Britain, and also had specimens illustrating the various stages in the manufacture of a glass stopcock. The methods employed for testing stopcocks for leakage were described.

Feldspar Development in North Carolina

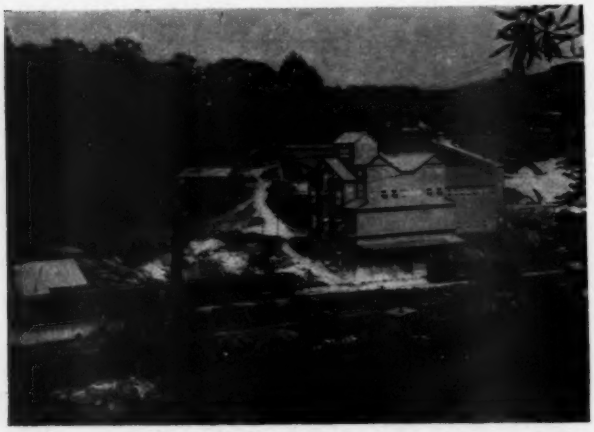
Early Struggles Involved in Modernizing the Industry

By B. C. BURGESS—*Tennessee Mineral Products Co.*

Part II[1]—Plant Description

THE plant is located on State Highway No. 19, two miles North from Spruce Pine, the center of the North Carolina feldspar producing area. The Clinchfield Railroad and Estatoe River are on the west side of the plant. The company's principal producing mines are across the river.

There is a narrow gauge railroad connecting the mines. A cableway transfers material from the Clinchfield Railroad



VIEW OF PLANT FROM COLUMBIA POWER & LIGHT COMPANY'S LINE

and narrow gauge railroad to the plant. There are two Clinchfield sidings, one for crude and another for finished product.

There are three lines of crude spar coming into the plant. Wagons and trucks haul from mines most accessible to the highways, the Clinchfield Railroad brings in spar from more distant sections and the company railroad from the nearby Deer Park mines.

Trucks and wagons dump their spar directly into crude bins. The spar hauled by the cableway is transferred by tram cars or, if run-of-mine grade, it is handled through the sorting plant as described later. There are forty-two crude bins, giving a total storage capacity of 8,300 tons. The purpose of segregating the storage to this extent is to separate the varying products of different mines and even in some instances the products from the same mine.

At the Deer Park mines of the company, all the material blasted is generally hoisted and sent to the plant as run-of-mine grade without any sorting except to pick out the large blocks of mica. The cableway transfers this to the sorting plant. There is a 200-ton bin to take up the surge between cableway and sorting plant. An apron feeder follows the primary bin. There is a speed adjustment on this feeder. An electric signal system connecting with the picking belt room permits the operators by this means to adjust the flow of the material to, and by, the sorters. The grizzly at the end of the apron feeder is of deformed steel bars spaced 4 inches apart. The jaw crusher beyond the grizzly is set to crush to 4 inches. Large pieces of pure No. 1 potash spar are picked direct from the apron feeder and transferred from the small bin underneath to the crude bins containing the same grade picked from the belt beyond this point.

The undersize of the grizzly joins the crusher product on a 16-inch incline conveyor underneath both. Between this conveyor and picking belt a deformed bar grizzly with ½-inch spacing is set to remove the fines.

The picking belt is 36 inches wide and 138 feet long. The chutes are spaced on each side of the belt, and between them the pickers stand.

These chutes connect with thirteen eight-ton transfer bins. A tram car line under these bins and over the crude bins permits the picking belt products to be placed in any of the crude bins. The transfer bins can be by-passed so as to drop the picking belt products directly to the crude bins underneath.

Sixteen women and girls and three men is the average crew on the picking belt. They remove from twenty-five to

PICKING BELT

forty tons of material from the 70 to 80 tons run over the picking belt in ten hours. This production depends upon the quality and size of the material from which they are picking. One of the men is foreman and the other two men are cobbers. Six products are picked from the belt, all from the product of one mine or from two or more mines run in together.

The first girl picks white flint, the next two remove No. 1 potash spar, then there are two women or girls picking No. 1 soda spar. Following these two or three are picking out No. 2 potash spar. The balance of the girls, excepting one picking mica, are removing whatever spar remains on the belt. This final product is all classed as No. 2 soda grade.

[1]Part I was published in the March, 1930, issue.

Whatever spar is saved by the two men cobbing at the lower end of the belt goes into this grade also.

The women have been found to more carefully grade the spar than men would do and they work for only a little more than half the wages it would be necessary to pay men for this class of work.

The stocks of crude spar in the 42 bins and additional ground storage is allowed to increase from a minimum of

CRUDE STORAGE BINS

4,000 tons in summer to 8,000 tons in winter. This will represent at least twenty different grades of spar from that of high potash and low soda content through the intermediate grades to the other extreme of high soda and low potash. These grades are allotted a number of bins proportional to the annual tonnage of each grade consumed. For instance there are many grades allotted only one bin each. On the other hand a crude spar grade of most common use may be allotted five or more bins.

The crude spar is transferred from these bins in wheel-

REAR VIEW OF CRUDE SPAR BINS

barrows, each grade separately, to two Reliance jaw crushers set to give a ½-inch to ¾-inch product.

While forking the spar into the wheelbarrows some fines are removed which are later put over a ¼-inch screen. The undersize is wasted and the oversize of the ¼-inch screen saved and run as a separate grade of crude spar.

Mechanical devices to replace this hand loading screening and wheelbarrow rolling have been studied but nothing has been found low enough in first cost to give a final result, after fixed and operating charges, less than the present per ton handling cost.

An 18-inch conveyor under the crushers takes the product over a by-pass to a cross conveyor and then on to the sampling unit. A tripper on the first of these conveyors dumps the spar into the rotary dryer. Since the dryer was installed, it has been found to so improve the product and increase grinding efficiency that the by-pass is not used.

The dryer is of the direct heat counter current type. Its furnace has an auxiliary stack for starting and baffles to prevent cinders from getting into the cylinder.

Wood is used for starting the coke fire. A stock grade coke is used costing $6.57 delivered at the plant. Experience shows that with the average moisture content 17 pounds of this fuel is required per ton of feldspar dried.

In lining the dryer 10 rows of silex were placed on end to form lifters to cascade or shower the feldspar through the

INTERMEDIATE STORAGE OR "MIXING" BINS

hot air. These have been found effective in lowering fuel requirements and increasing capacity of the dryer.

An exhust fan pulls the air against the flow of material. In doing so it pulls out practically all of the minus 40 mesh material. This material is largely mica, clay and other impurities. In removing these an improvement is made in the quality of the finished product to more than offset the cost of drying.

The sample unit receives, by the system of conveyors previously mentioned, all spar from the crushers and dryer. A swinging chute actuated by a revolving cam removes 2% and passes it to a set of rolls crushing to 8 mesh. Under the rolls is another sampler of similar design which removes 5% of the roll product. The resulting sample is 5% of 2% or 1 pound of every 1,000 pounds entering the unit.

The reject from the samplers, constituting 99.9% of the material entering the unit, is elevated to a cross conveyor which in turn feeds a shuttle conveyor. This shuttle conveyor is mounted on a track and is reversible so that it can be set to load any one of the 20 mixing bins underneath it.

It has been noted that each grade of crude spar is run to the crushers separately. This separate lot is continued on through the dryer and sampling unit into a separate mixing

bin. In making the run 1 pound has been removed out of each 1,000. The capacity of each mixing bin is 80 tons, which would result in a 160-pound sample. Smaller lots down to 30 tons are often handled, however, resulting in a proportionately smaller sample. This sample is quartered and split down by standard methods and sent to a laboratory for complete chemical analysis. No part of this mixing bin lot is drawn out until the analysis is reported.

This process, continued, results in an intermediate storage of 1,000-1,600 tons of crushed material in twenty separate lots ready for fine grinding. The analysis of each lot is known or is being determined in the laboratory.

When an order is received, it is passed to the laboratory. There a mix is calculated from the known contents of the mixing bins to fit the customer's specifications.

A form is filled in showing the number of parts to be drawn from each bin to make up the shipment. These parts are drawn 330 pounds at a time and dumped in the elevator which loads the surge bin of the fine grinding unit in which the order is to be run.

There are three of these surge bins, one for each fine grinding unit. An automatic belt feeder under each bin conveys the spar to each of the Harding mills. All of the chutes and feeding mechanisms are silex or rubber lined. The mills are silex lined and flint pebbles are the grinding medium.

The discharge from each mill is elevated, either to Gayco separators or Hummer vibrating screens, according to whether

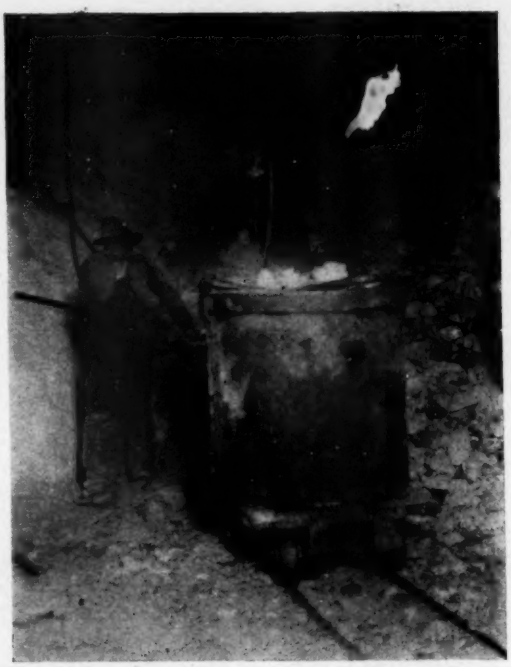
DEER PARK—NO. 2 MINE

the order is fine (120-250 mesh) or coarse (20-40 mesh) grinding. If it is an intermediate grinding (60-100 mesh) both the separators and screens are used, taking out first the fines, then running the separator oversize to the screens where the final sizing is done.

A tube mill is operated for fine grinding in connection with the number one unit. This tube mill gets about half the oversize from the Gayco. It reduces this oversize with less power than if the same grinding were done in a conical mill and increases the plant capacity about 8 per cent.

The finished product is elevated from screens or separators to the top of the plant where automatic samplers, similar to those in the sample unit, take a final sample of the output. These samples are taken to the laboratory and checked against the calculated analysis. A 2-ounce sample of every shipment is kept at the laboratory as a permanent record. Larger samples of material for which there is steady demand from prospective customers are stored in the warehouse adjoining the plant.

From the finished product samplers the spar can be spouted directly into the cars or temporarily into any one of five finished products bins each of fifty tons' capacity.



FIRST BENCH IN DEER PARK—NO. 2 MINE

The design of the fine grinding section of the plant permits great flexibility. This flexibility permits maximum use of the equipment and very large capacity to handle rush orders of any commercial grinding.

To consumers familiar only with the simple flow sheet of the average grinding plant, the one described may seem unnecessarily expensive and complicated. Experience has proven that every step in the process is necessary for the production of uniform products of known analysis The essential features are segregation of the crude, continued segregation through intermediated storage, blending on the basis of chemical analysis and finally neutralizing consecutive grindings whenever there is appreciable analysis difference between them.

As the result of the placing on the market of a dependable feldspar from North Carolina, there has been continually increasing interest and investment in the industry in this State. It is now producing 50 per cent of all the United States production of crude feldspar and this with only one fourth of the country's grinding capacity. The quality of the product would not alone account for this tremendous proportional increase in North Carolina production.

Other important factors are: 1. Frequency with which feldspar outcrops occur in North Carolina area. 2. Wide range

of analysis of deposits. 3. Cheap and efficient labor. 4. Good transportation. 5. Large investment in mines and plant.

Even with these advantages, however, no one section of the country will ever supply all the feldspar consumed. The sources of crude spar are so distributed that freight rates have an important influence. Rates from existing plants range up to 70 per cent of the price of the spar at the plant.

Another factor of recent importance is the quick delivery of spar which consumers are requiring. Since the railroads

CONTRACT OPERATIONS AT HENRY SMITH MINE

have established the practice of handling carload freight at express speed, few consumers are carrying any stocks. In spite of the wonderful service given by railroads, a distant producer is still at a disadvantage compared to one located nearer the ceramic center.

From 1921-1924 there was an average annual increase in production of feldspar amounting to about 60,000 in the tonnage. This is the period in which glassmakers began using feldspar and the increase may be largely allotted to this new use.

North Carolina, with its cheap, high-alumina spar got practically all of this tonnage and still holds it. Although it looks good on the map, it does not show up so well in the statements of the producing companies. The glass companies are getting this spar almost at the actual cost of production.

This brings us down to the question of prices.

Eighty-five per cent of the feldspar produced in the United States is ground in Hardinge Conical Mills, preceded by jaw crushers. The remaining 15 per cent is ground in tube or batch mills for which the preliminary crushing is usually done with chaser stones.

Two ordinary batch mills take up about as much floor space and require approximately the same power as the average size conical mill unit. Good production for the two batch mills is 16 tons of 200 mesh feldspar in 24 hours. Average production for the conical mill unit is 40 tons of that grinding in 24 hours.

If the batch miller is making enough profit to enable him to continue in business, it would seem that the conical mill operator should be making big profits. That is far from the case however.

Cost of grinding is a comparatively small factor in determining the selling price of feldspar. The determining factors are those dependent on tonnage. To illustrate this, let us compare percentages of the factors making up selling price.

	Percent
1. Crude Cost	43
2. Milling	16
3. General Expense	18
4. Selling	10
5. Return on Capital	13
	100

Under crude cost and milling we include only direct operating expense so that these two items depend very little on tonnage, that is the relation of shipments to capacity. The other three items, however, are entirely dependent on tonnage. If plants are operating at 50 per cent general expense and selling charges will be almost twice as much per

THE MINPRO LABORATORY

ton as they would be at capacity. The proportional return at different percentages of capacity is as follows:

Percent Capacity	Percent Profit
35	2
40	6
50	13
75	20
100	27

At present prices 13 per cent profit represents only 4½ per cent return on capital invested in the business. This is about what is being earned. The Bureau of Mines report recently issued for 1928, states there were 31 grinding plants operating last year. These mills reported sales of 227,657 short tons of ground feldspar or an average of 7,344 tons each.

This is close to 50 per cent of the capacity of the average plant. We have previously shown that at 50 per cent, the grinders are making 4½ per cent on capital invested.

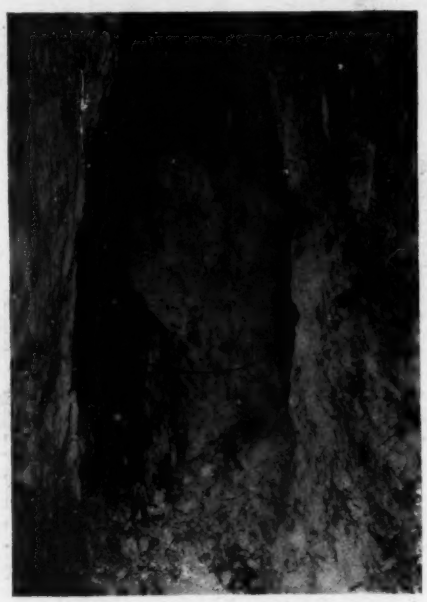
No industry will continue long on this basis. If the business is to remain split up among 31 plants, prices must be raised. The consumers, however, are largely responsible for this situation and have it within their power to relieve it.

Ray Hutchins, Assistant Director, National Bureau of Standards, says, "Profits are no longer the difference between selling price and cost. Instead they are the difference between new ideas and old ones, new methods and out-of-date ones, new equipment and obsolete equipment."

Part of the present investment in the feldspar business has been on this basis. Consumers are not taking full advantage of it, however, but are still influenced by ignorance and prejudice or "high powered" sales pressure to scatter their business to the extent that they are supporting double the necessary number of plants.

The solution is for consumers to investigate the sources of supply either individually or collectively through their associations. This is all that will be necessary. The difference is so great that the obsolete and "wildcat" groups would soon be eliminated.

Of course the same result will be accomplished in time through natural processes. If the "wildcat" outfits continue to enter the business every few months the situation may continue indefinitely, meanwhile the industry is losing about four hundred thousand dollars per year.



DEER PARK NO. 5 MINE

Blazing the Way to Broadway

By JOSEPH H. O'NEIL [1]

THE rapidly increasing use of Neon electric displays has developed in a few short years what might be termed a new industry. As tubes of glowing red, blue, and green lights call attention to well-known products, the public may not realize the important place gas [and glass] occupy in the manufacture of these modern electric advertising displays.

A CORNER OF THE GLASS ROOM OF THE ELECTRICAL PRODUCTS CORP., SALT LAKE CITY

The theory of neon lighting is simple, i.e., pure neon gas is a conductor of electricity and forms a part of a complete electric circuit. A natural phenomenon, however, causes the brilliant red light. When neon gas is agitated by electricity it activates the molecules, which glow brightly. The neon must be separated and contained to prevent its absorption by the air. Consequently we have the familiar glass tubes which are seen in growing numbers throughout the country, and it is in the matter of sealing, annealing, bending, and shaping these glass tubes that gas plays so important a part.

ROOF DISPLAY SIGN IN JERSEY CITY USING CLAUDE NEON TUBES

Claude Neon Lights, the original and largest manufacturers of neon products, with thirty associated licensed companies in the United States, depend on gas entirely in their various glass departments, which it is estimated consume approximately 90,000,000 cu. ft. yearly. The total sales of Claude Neon displays are averaging $18,000,000 a year, which is amazing when the comparatively recent origin of the business is considered.

In the glass blowing departments of the neon factories

[1] Claude Neon Lights, Inc., in *Industrial Gas.*

ordinary illuminating gas has been found most economical and efficient. Where natural gas only is available, special compensators are required for a pre-mixture before the gas is fed into the burners. The average glass rooms utilize an assortment of burner types, cannon fire, fish tail burners, ribbon burners, cross fires, and hand torches. It is found that the annealing process is best performed by soft gas

A CORNER OF THE GLASS ROOM OF THE ALPHA CLAUDE NEON CORP., PITTSBURGH, SHOWING A VARIETY OF GAS BURNERS

flames. Glass strain is prevented by not allowing the tubes to cool too rapidly.

In the actual blowing and shaping of the glass tubes, gas flames are speediest and most efficient, as the heat can be regulated to a fine degree. As the glass tubes are one of the most important parts of a neon display, the tubes must be without weak spots and all the curves must be of equal diameter to give equal brilliancy to each part of the letter or design. One of the advantages of a Claude Neon sign is the

GLASS ROOM IN THE LONG ISLAND CITY FACTORY OF CLAUDE NEON LIGHTS, INC.

even distribution of light which permits easy legibility from a great distance.

An interesting feature of Claude Neon displays is that the light is cold and does not heat up the tubes after continued operation. Also they use only a small part of the electric current required for other types of light. They can be shaped to reproduce any style of letter or trade mark exactly, and a variety of color tones are available in blues, red, yellows, and greens. They are the most modern and forceful electric displays and gas has contributed largely in their manufacture in the practical, efficient form in which we see them today.

Society of Glass Technology

An ordinary General Meeting of the Society of Glass Technology was held in Sheffield, on Wednesday, February 19, 1930. Three papers were presented.

(a) "THE TERNARY SYSTEM K_2O-CaO-SiO_2." By G. W. Morey, F. C. Kracek, and N. L. Bowen. (*A communication from the Geophysical Laboratory, Washington, D. C., U. S. A.*)

This study of phase equilibrium relations in the system K_2O-CaO-SiO_2 was one of a series of papers dealing with various combinations of rock-forming ingredients, in each of which one or more of the alkali oxides was present. The compositions studied gave in detail the melting relations in that portion of the ternary system from potassium metasilicate, K_2O-SiO_2, to potassium calcium orthosilicate, K_2O-CaO-SiO_2, to wollastonite, CaO-SiO_2, and all more siliceous mixtures. Less siliceous mixtures were difficult to study because of the volatility of K_2O, of the highly hygroscopic nature of mixtures rich in K_2O, and of the difficulty of freeing these preparations of CO_2, or because of the high temperatures involved, but data were given for a few compositions outside of the above limits. The density and optical properties of the glasses composed of these three oxides throughout the range within which it was possible to form glasses in the laboratory had been determined and would be published later. The entire program was preliminary to the addition of water to these same systems, and the study of the equilibrium relations in the systems so obtained at high pressure and temperature, with a view to the application of the knowledge so obtained to the elucidation of geologic and technical problems.

(b) "NOTE ON THE DETERMINATION OF BORIC OXIDE IN GLASS." By Violet Dimbleby, M. Sc. (*Department of Glass Technology, The University, Sheffield.*)

The difficulties attendant upon the determination of boric oxide in glass were enumerated by Miss Dimbleby, who explained that the method of E. T. Wherry, and the modified procedure suggested by E. C. Sullivan and W. C. Taylor, previously investigated some years ago in the Department of Glass Technology, at Sheffield, by J. D. Cauwood and T. E. Wilson, (see *J. Soc. Glass Tech.* 1918, 2, 246,) had yielded satisfactory results in the Department. The methods had been applied frequently to glasses differing widely in composition.

Independent workers, however, employing these methods, particularly that of Wherry, applied to the determination of small quantities of boric oxide in simple glasses, had found considerable difficulties. Accordingly, the method was well discussed with several analysts, and a further series of tests was undertaken at Sheffield, to discover the points at which errors could creep into the work, and the likely magnitude of such errors.

Particulars of these tests and the results obtained, were given, and the procedure previously outlined for the determination, was modified and amplified. It was shown that in order to arrive at accurate results, the amount of calcium carbonate used for precipitation and the time of boiling must be carefully regulated. This precipitate should be dissolved in hydrochloric acid and reprecipitated.

Close agreement had been obtained in results got by an independent analyst, and two workers at Sheffield, when determining the low boric oxide content of a simple commercial glass, the procedure being such as to include the precautions mentioned above.

DISCUSSION

An interesting discussion followed the reading of this paper, the members taking part being: Professor W. E. S. Turner (Sheffield), Messrs. F. W. Adams (Greenford), A. J. Somer (London), F. Winks (Sheffield), B. P. Dudding (London), F. G. Clark (Rotherham). Miss Dimbleby replied.

The election of Edward Orton, Jr., to the presidency of the American Ceramic Society, as previously mentioned, was effected at the annual meeting of the American Ceramic Society at Toronto. Paul E. Cox is the new vice-president. H. B. Henderson, treasurer, and Ross C. Purdy, general secretary, were re-elected. J. T. Littleton of the Corning Glass Works is chairman of the Glass Division for the ensuing year and S. R. Scholes of the Fostoria Glass Company is in charge of the Division papers and program. In the Refractories Division, C. F. Geiger was elected chairman, Dorothy A. Texter, secretary. E. deF. Curtis heads the Art Division and Myrtle French is secretary.

Glass Industry

ESTABLISED 1920

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Spread Useful News More Quickly

The need exists in the American glass industry for a clearing house of miscellaneous information. A few of the larger and wealthier corporations have such institutions of their own, covering the field in which they are particularly interested, but no such institution exists for the great bulk of the companies or workers in this field, or covering the whole territory of the whole industry. For this purpose we offer the hospitality of our columns.

To the Research Worker:

The Editor will be glad to receive preliminary announcements of new discoveries or comments thereon. THE GLASS INDUSTRY is not a journal in which to publish deeply technical original researches; it has no desire to compete with the *Journal of the American Ceramic Society,* or with the Society of Glass Technology. But inasmuch as several months must in all cases elapse before a scientific paper can be printed *in extenso* in either of the foregoing journals, we believe that the authors' co-workers would welcome a brief preliminary announcement of the salient results of investigations in THE GLASS INDUSTRY. Such announcements can usually be assured of prompt publication in our pages, and they should preferably state where the final paper is expected to be published.

To Works Superintendents and Men in the Shop:

The Editor is at all times glad to receive inquiries on questions of shop practice and to answer them whenever possible. There are many questions of shop practice on which we confess complete ignorance, and many to which the answers are not known either by us or by others. But wherever possible the problem will be submitted to men whom we consider likely to know the answer; a reply will be sent by mail to the inquirer, and if the matter is of general interest, we shall have pleasure in publishing both inquiry and answer in our columns.

Technical Consultation Service

Rouge for Polishing Glass

QUESTION 117.—Why do you not publish the price of rouge in your quotations of glass-making materials? We notice that other journals quote variable prices, and would like to know what the prevailing price is. Have plate glass manufacturers any specifications for rouge?

ANSWER.—Rouge, iron oxide in a form that will polish glass, is so unstandardized a material that quotations are apt to be misleading.

The largest spectacle-lens makers use ground haematite (native iron ore) as their polishing medium. Such material is apt to contain a little silica, which may be very troublesome.

In France, many lens-workers used to prepare their rouge by calcining the citrate or oxalate of iron, but this is too expensive for large scale operation.

The general source of rouge for the plate glass industry in this country is ferrous sulphate (copperas), from the pickling vats of the steel industry, where it occurs as a waste product. This is calcined, generally in a very crude and uncontrolled fashion, and produces a mixture that is mainly ferric oxide (Fe_2O_3), but contains varying amounts of the magnetic oxide (Fe_3O_4), and "free acid," i. e., undecomopsed sulphates. In the optical glass industry some effort is made to eradicate the free acid by washing later, since it is apt to produce staining of the glass, but in the plate glass industry, a certain "acid" content is desired and standardized, though the standard varies from plant to plant. The magnetic

oxide is generally gritty, and is a frequent source of sleeks or fine scratches. For the optical industry it is so troublesome that I found it convenient to test a new variety of rouge first by its reaction to an electromagnet, and if any perceptible proportion showed pronounced magnetic behavior, the consignment was rejected.

The ferric oxide, which is the genuine red material or rouge, is itself of quite variable physical constitution; its color varies from an orange almost approximating a yellow, to a purple or brown. Its density is very variable also, and increases with the amount of firing to which it has been subjected. It has been my experience that the more severe the firing the better, provided that the material is not converted to the black oxide. That is, the denser the rouge, the better; a good rouge should have a density of about 4.2 (specific gravity). In recent years a chemical rouge has been put on the market, which has a very low density; this rouge is free from sulphate ("acid"), and from objectionable gritty matter, both silica and magnetic oxide; it polishes well if used promptly, but apparently loses its power if kept a comparatively short time in water.

Most plate glass manufacturers seem to prefer to make their own rouge from the copperas; in many cases the resulting product is far from good, but the foreman or superintendent can modify it till he gets a variety that seems to work well in his particular plant. The Pittsburgh Plate Glass Company, for instance, who were until recently purchasing from outside sources, have now installed their own equipment. So far as I know, there are no specifications for rouge used by any American manufacturer; the only requirement is that it shall suit the superintendent on a practical trial, and it is hoped that thereafter subsequent batches or consignments will be similar to the one first approved.—F. W. P.

Plaster of Paris

QUESTION 118—We understand that hydrated lime is used as an admixture with plaster of paris for bedding plate glass on the grinding table, and that the proportions used are 90 per cent. plaster of paris and 10 per cent. hydrate of lime. Would it be possible for you to let us know whether this is in accordance with present practice in the plate glass field?

ANSWER.—I was informed some years ago that some manufacturers of plaster for glass-bedding purposes incorporated from 5 to 10 per cent. of "free lime," presumably meaning free CaO; they are said also to use a small amount of colloids such as beef-blood. The purpose of the additional ingredients is to control the strength of the plaster and its rate of setting. Manufacturers who have used my laboratories to develop their mixtures are none the less unwilling to give any information as to their conclusions, but chemical and microscopical examination of the plaster should provide an answer to the questions raised.

Some manufacturers state that they use hydrate of lime to the extent of 1¾ to 2½ per cent. Other manufacturers inform me that they have not been in the habit of adding other materials, but depend on the control of the firing of the original calcium sulphate (gypsum).—F. W. P.

Dutiable List of Glassware and Glassmaking Materials of the Proposed Tariff Act of 1929 (H. R. 2667)

As passed by the Senate on March 24, 1930, and referred to a Joint House and Senate Committee Conference for adjustment. The measure as revised must then be passed by both House and Senate and approved by the President before becoming a law.

(The items listed were compiled and published by the New York *Times*)

Part of Schedule 1—Chemicals, Oils and Paints

COMMODITY	RATE OF DUTY			
	Underwood-Simmons Tariff, 1913	Fordney-McCumber Tariff, 1922	Hawley-Smoot House Bill	Hawley-Smoot Senate Bill
Boric acid (lb.)	¾c.	1½c.	1½c.	1c.
Citric acid (lb.)	5c.	17c.	18c.	17c.
Tartaric acid (lb.)	3½c.	6c.	8c.	8c.
Arsenious acid or white arsenic (lb.)	Free	Free	Free	2c.
Nitric acid (lb.)	Free	Free	½c.	Free
Acetone and ethyl methyl ketone and their homologues, and acetone oil (lb.)	1c.	25%	25%	20%
Antimony compounds:				
Oxide (lb.)	25%	2c.	2c.	½c. to 4c.
Barium compounds:				
Barium oxide (lb.)	15%	25%	2½c.	2½c.
Collodion and other liquid solutions of pyroxylin, of other cellulose esters or ethers, or of cellulose (lb.)	15%	35c.	35c.	30c.
(a) Cellulose acetate, and compounds, combinations, or mixtures containing cellulose acetate:				
(1) In blocks, sheets, rods, tubes, powder, flakes, briquets, or other forms, whether or not colloided, and cellulose acetate rayon waste and other cellulose acetate waste not made into finished or partly finished articles	..	10%; 40c.	50c.	50c.
(2) In finished or partly finished articles, n. s. p. f.	..	60%	80%	80%
(b) Cellulose compounds, including pyroxylin and other cellulose esters and ethers, combinations or mixtures:				
Transparent sheets more than 3/1000 of 1 inch and not more than 32/1000 of 1 inch in thickness (lb.)	25%	40c.	45c.	45c.
Transparent sheets of cellulose not exceeding 3/1000 of 1 inch in thickness	25%	25%	45%	45%
Ethers and esters:				
Amyl acetate (lb.)	5c.	25%	25%	7c.
Formaldehyde solution or formalin (lb.)	1c.	2c.	2c.	1½c.
Inedible gelatin valued at less than 40c. per pound (lb.)	15%	1½c.+20%	2c.+25%	2c.+20%
Inedible gelatin valued at 40c. or more per pound (lb.)	25%	7c.+20%	8c.+25%	7c.+20%
Magnesium compounds:				
Sulphate or Epsom salts (lb.)	0.1c.	½c.	1c.	½c.
Oxide or calcined magnesia (lb.)	3½c.	3½c.	7c.	5c.
Potassium compounds:				
Permanganate (lb.)	1c.	4c.	6c.	6c.
Nitrate or saltpeter, refined	$7 ton	1½c. lb.	5½c. lb.	1c. lb.
Sodium, Lithium, Beryllium, and caesium	10%	Free (4)	Free	25%
Sodium Compounds:				
Borate or borax, refined (lb.)	⅛c.	⅛c.	⅛c.	Free
Silicofluoride (lb.)	15%	25% (5)	1¾c.	1½c.

Part of Schedule 2—Earths, Earthenware, and Glass

COMMODITY	RATE OF DUTY			
	Underwood-Simmons Tariff, 1913	Fordney-McCumber Tariff, 1922	Hawley-Smoot House Bill	Hawley-Smoot Senate Bill
Chemical and other scientific glassware:				
Lamp-blown advolumetric ware	45%	65%	85%	85%
Articles for chemical, scientific and experimental purposes, n. e. s.	Free	65%	85%	85%
Same, of fused quartz	20%	30%	50%	50%
Fused quartz tubes or tubing	20%	30%	40%	40%
Illuminating glassware:				
Chimneys	45%	60%	65%	55%
Globes, shades, prisms, &c.	45%	60%	65%	70%
Blown glass tableware:				
Blown or partly blown	45%	55%	60%	60%
Glassware cut, engraved, ornamented, &c.	45%	55%	60%	60%
Other blown glassware, n. e. s.	45%	55%	60%	60%
Tube gauge glasses	45%	55%	65%	55%
Blown glass perfume and toilet bottles	45%	55%	70%	75%
Pressed glass tableware:				
Cut, engraved, ornamented, &c.	45%	55%	60%	60%
From Cuba	45%—20%	55%—20%	60%—20%	60%—20%
Christmas-tree ornaments	45%	55%	60%	60%
Cylinder, crown, and sheet glass, unpolished:				
Weighing less than 80 pounds net per case:				
Not over 150 square inches (lb.)	⅞c.	1¼c.	1⅞c. (4)	1⅞c.
Over 150 and not over 384 sq. in. (lb.)	1c.	1⅜c.	2 1/16c. (4)	2 1/16c.
Over 384 and not over 720 sq. in. (lb.)	1⅛c.	1⅝c.	2 7/16c. (4)	2 7/16c.
Over 720 and not over 864 sq. in. (lb.)	1½c.	1¾c.	2⅝c. (4)	2⅝c.
Over 864 and not over 1,200 sq. in. (lb.)	1¾c.	2c.	3c. (4)	3c.
Over 1,200 and not over 2,400 sq. in. (lb)	1⅞c.	2¼c.	3⅜c. (4)	3⅜c.
Over 2,400 sq. in. (lb.)	2c.	2½c.	3¾c. (4)	3¾c.
Weighing 80 pounds net and over per case:				
Not over 150 square inches (lb.)	⅞c.	1¼c.	1⅞c. (4)	1⅞c.
Over 150 and not over 384 sq. in. (lb.)	1c.	1⅜c.	2 1/16c. (4)	2 1/16c.
Over 384 and not over 720 sq. in. (lb.)	1⅛c.	1⅝c.	2 7/16c. (4)	2 7/16c.
Over 720 and not over 864 sq. in. (lb.)	1½c.	1¾c.	2⅝c. (4)	2⅝c.
Over 864 and not over 1,200 sq. in. (lb.)	1½c.	2c.	3c. (4)	3c.
Over 1,200 and not over 2,400 sq. in. (lb)	1⅞c.	2¼c.	3⅜c. (4)	3⅜c.
Over 2,400 sq in. (lb.)	2c.	2½c.	3¾c. (4)	3¾c.
Cylinder, crown and sheet glass, polished, (5):				
Not over 384 sq. in. (sq. ft.)	3c.	4c.	12½c. (6)	12½c.
Over 384 and not over 720 sq. in. (sq. ft.)	4c.	6c.	19c. (6)	19c.
Over 720 and not over 1,440 sq. in. (sq. ft.)	7c.	12c.	22c. (6)	22c.
Over 1,440 sq. in. (sq. ft.)	10c.	15c.	22c. (6)	22c.
Laminated glass, composed of layers of glass and other materials, &c.	30%	50%	60%	60%
Fluted, rolled, ribbed, or rough plate glass or the same containing wire netting. (Excess over 100 pounds per 100 square feet dutiable at same rate):				
Not over 384 sq. in. (sq. ft.)	½c.	¾c.	1c.	1½c. (lb.)
Over 384 sq. in. (sq. ft.)	1c.	1½c.	2c.	1½c. (lb.)
Fluted, rolled or ribbed, plate glass, when ground, smoothed, or obscured:				
Not over 384 sq. in. (sq. ft.)	6c.	12½c.	12½c. (6)	12½c.
Over 384 and not over 720 sq. in. (sq. ft.)	8c.	15c.	19c. (6)	19c.
Over 720 sq. in. (sq. ft.)	12c.	17½c.	22c. (6)	22c.
Cast, polished, unsilvered plate glass:				
Not over 384 sq. in. (sq. ft.)	6c.	12½c.	12½c. (6)	12½c.
Over 384 and not over 1,008 sq. in. (sq. ft.)	8c.	15c.	19c. (6)	17c.
Over 1,008 sq. in. (sq. ft.)	12c.	17½c.	22c. (6)	19¾c.
Same, containing wire netting:				
Not over 384 sq. in. (sq. ft.)	6c.	15c.	17c. (6)	13½c.
Over 384 and not over 720 sq. in. (sq. ft.)	8c.	17½c.	20c. (6)	20c.
Over 720 sq. in. (sq. ft.)	12c.	20c.	23c. (6)	23c.
Cast polished plate glass and polished window glass silvered and used as mirrors and looking-glasses over 144 square inches:				
Not over 384 square inches (sq. ft.)	7c.	13½c.	17c. (6)	13½c.
Dutiable at minimum rate	7c.	35%	45% (6)	45%
Over 384 and not over 720 square inches (sq. ft.)	9c.	16c.	20c. (6)	20c.
Dutiable at minimum rate	9c. sq. ft.	35%	45% (6)	45%
Over 720 square inches (sq. ft.)	13c.	21c.	23c. (6)	23c.
Dutiable at minimum rate	13c. sq. ft.	35%	45% (6)	45%
Cylinder, crown and sheet glass, silvered and looking-glass plates over 144 sq. in.—				
Not over 384 sq. in. (sq. ft.)	4c.	13½c.	17c. (6)	13½c.
Dutiable at minimum rate	4c. sq. ft.	35%	45% (6)	45%
Over 384 and not over 720 sq. in. (sq. ft.)	5c.	16c.	20c. (6)	20c.
Dutiable at minimum rate	5c. sq. ft.	35%	45% (6)	45%
Over 720 sq. in. (sq. ft.)	8c.	21c.	23c. (6)	23c.
Dutiable at minimum rate	8c. sq. ft.	35%	45% (6)	45%
Polished plate glass and window glass, bent, ground, obscured, ornamental, etc., plate glass cast, polished, unsilvered:				
Not over 384 square inches (sq. ft.)	6c.+4%	12½c.+5%	12½c.+5% (6)	12½c.+5%
Over 384 and not over 720 square inches (sq. ft.)	8c.+4%	17½c.+5%	20c.+5% (6)	20c.+5%
Over 720 square inches (sq. ft.)	12c.+4%	17½c.+5%	22c.+5% (6)	22c.+5%
Containing wire netting—				
Not over 384 square inches (sq. ft.)	6c.+4%	15c.+5%	17c.+5% (6)	17c.+5%
Over 384 and not over 720 square inches (sq. ft.)	8c.+4%	15c.+5%	19c.+5% (6)	19c.+5%
Over 720 square inches (sq. ft.)	12c.+4%	20c.+5%	23c.+5% (6)	23c.+5%

Schedule 2—(Continued)

COMMODITY	RATE OF DUTY — Underwood-Simmons Tariff, 1913	Fordney-McCumber Tariff, 1922	Hawley-Smoot — House Bill	Hawley-Smoot — Senate Bill
Plate glass, cast, polished, silvered, and looking-glass plates, exceeding in size 144 square inches—				
Not over 384 square inches (sq. ft.)	7c.+4%	13½c.+5%	17c.+5% (6)	13½c.+5%
Dutiable at minimum rate	7c.+4%	40%	50% (6)	50%
Over 384 and not over 720 square inches (sq. ft.)	9c.+4%	16c.+5%	20c.+5% (6)	20c.+5%
Dutiable at minimum rate	9c.+4%	40%	50% (6)	50%
Over 720 square inches (sq. ft.)	13c.+4%	21c.+5%	23c.+5% (6)	23c.+5%
Dutiable at minimum rate	13c.+4%	40%	50% (6)	50%
Bent, obscured, beveled, colored, ornamental, &c., glass, cylinder, crown and sheet glass, unpolished:				
Not over 150 square inches (lb.)	7/8c.+4%	1¼c.+5%	1⅞c.+5% (4)	1⅞c.+5%
Over 150 and not over 384 sq. in. (lb.)	1c.+4%	1⅜c.+5%	2 1/16c.+5% (4)	2 1/16c.+5%
Over 384 and not over 720 sq. in. (lb.)	1⅜c.+4%	1⅝c.+5%	2 7/16c.+5% (4)	2 7/16c.+5%
Over 720 and not over 864 sq. in. (lb.)	1½c.+4%	1¾c.+5%	2⅝c.+5% (4)	2⅝c.+5%
Over 864 and not over 1,200 sq. in. (lb.)	1½c.+4%	2c.+5%	3c.+5% (4)	3c.+5%
Over 1,200 and not over 2,400 sq. in. (lb.)	1⅞c.+4%	2¼c.+5%	3⅜c.+5% (4)	3⅜c.+5%
Over 2,400 square inches (lb.)	2c.+4%	2½c.+5%	3¾c.+5% (4)	3¾c.+5%
Polished:				
Not over 384 sq. in. (sq. ft.)	3c.+4%	4c.+5%	12½c.+5% (6)	12½c.+5%
Over 384 and not over 720 sq. in. (sq. ft.)	4c.+4%	6c.+5%	19c.+5% (6)	19c.+5%
Over 720 and not over 1,440 sq. in. (sq. ft.)	7c.+4%	12c.+5%	22c.+5% (6)	22c.+5%
Over 1,440 square inches (sq. ft.)	10c.+4%	15c.+5%	22c.+5% (6)	22c.+5%
Cylinder crown and sheet glass, silvered and looking-glass plates:				
Over 144 and not over 384 sq. in. (sq. ft.)	4c.+4%	13½c.+5%	17c.+5% (6)	13½c.+5%
Dutiable at minimum rate (sq. ft.)	4c.+4%	40%	50% (6)	50%
Over 384 and not over 720 sq. in. (sq. ft.)	5c.+4%	16c.+5%	20c.+5% (6)	20c.+5%
Dutiable at minimum rate	5c.+4%	40%	50% (6)	50%
Over 720 square inches (sq. ft.)	8c.+4%	21c.+5%	23c.+5% (6)	23c.+5%
Dutiable at minimum rate	8c. sq. ft.	40%	50% (6)	50%
Optical glass:				
For spectacles	Free	45%	50%	45%
For optical instruments	Free	45%	50%	45%
Spectroscopes, spectrometers, &c	35%	45%	60%	60%
Electric lamps:				
Incandescent—				
Carbon filaments	30%	20%	30%	30%
Metal filaments	30%	20%	30%	20%
Other, including neon, mercury, &c	30%	20%	30%	20%
Windows, stained or painted	30%	50%	60%	60%
Manufactures of glass, ruled or etched for photographic reproduction of engraving processes, &c	15%	Free	50%	55%
Other ruled glass	45%	55%	50%	50%
Windows valued over $15 per square foot and not over $35 per square foot	Free	Free	Free	60%

(1) Rate of duty on crude magnesite changed by Presidential proclamation from 1/16 cent per pound to 1/32 cent per pound, effective Dec. 10, 1927.

(2) Rate of duty on fluorspar containing not more than 93 per cent calcium fluoride changed by Presidential proclamation from $5.60 per ton to $8.40 per ton, effective Nov. 16, 1928.

(3) Also carries an additional duty of 10 cents per dozen on plates, cups and saucers valued at 50 cents per dozen or less.

(4) Rates of duty on window glass (cylinder crown and sheet glass, unpolished) changed by Presidential proclamation, effective June 13, 1929, as follows: Not over 150 square inches, from 1¼ cents per square foot to 1⅞ cents per square foot. Over 150 square inches and not over 384 square inches, from 1⅜ cents per square foot to 2 1/16 cents per square foot. Over 384 square inches and not over 720 square inches, from 1⅝ cents per square foot to 2 7/16 cents per square foot. Over 720 square inches and not over 864 square inches, from 1¾ cents per square foot to 2⅝ cents per square foot. Over 864 square inches and not over 1,200 square inches, from 2 cents per square foot to 3 cents per square foot. Over 1,200 square inches and not over 2,400 square inches, from 2¼ cents per square foot to 3⅜ cents per square foot. Over 2,400 square inches, from 2½ cents per square foot to 3¾ cents per square foot.

(5) Polished cylinder, ground and sheet glass take same rate as cast polished plate glass and under H. R. 2667 is transferred to paragraph 222.

(6) Rates of duty on cast polished plate glass, finished or unfinished, and unsilvered, changed by Presidential proclamation, effective Feb. 16, 1929, as follows: Not exceeding 384 square inches, from 12½ cents per square foot to 16 cents per square foot. Over 384 square inches and not over 720 square inches, from 15 cents per square foot to 19 cents per square foot. Over 720 square inches, from 17½ cents per square foot to 22 cents per square foot.

Plaster rock or gypsum:				
Ground (ton)	10%	$1.40	$1.40	$3.00
Calcined, or plaster of Paris (ton)	10%	$1.40	$1.40	$3.00
China clay or kaolin:				
Crude (ton)	$1.25	$2.50	$2.50	$2.50
Washed (ton)	$1.25	$2.50	$2.50	$2.50
Silica:				
Crude, n. s. p. f. (ton) and glass sand 95% or more silica	Free	$4.00	$4.00	$3.50
Fluorspar:				
High grade (ton)	$1.50	$5.60	$8.40	$8.40
Not exceeding 93% $CaFl_2$ (ton)	$1.50	$8.40 (2)	$8.40	$8.40
Feldspar, crude (ton)	Free	Free	$1.50	$1.00
Talc, steatite, soapstone, French chalk, and manufactures of:				
Ground, washed, powdered, &c. (except toilet preparations) (lb.)	15%	25%	3/8c.	25%

Part of Schedule 3—Metals and Manufactures of

Manganese ore, containing over 10% of metallic manganese (manganese content) (lb.)	Free	1c.	1c.	1c.

Additional Items in Tariff Bill

(*Continued from page* 91)

Par. 81. Soda ash, hydrated ¼ cent per pound.

Par. 203. Limestone (not suitable for use as monumental or building stone), crude, or crushed but not pulverized, 5 cents per one hundred pounds; lime, not specially provided for, 10 cents per one hundred pounds, including the weight of the container; hydrated lime, 12 cents per one hundred pounds, including the weight of the container.

Par. 207. Gross-Almerode glass pot clay $1.00 per ton. Sand containing 95 per cent or more of silica and suitable for use in the manufacture of glass, $3.50.

Par. 217. Bottles, vials, jars, ampoules, and covered or uncovered demijohns, and carboys, any of the foregoing, wholly or in chief value of glass, filled or unfilled, not specially provided for, and whether their contents be dutiable or free (except such as contain merchandise subject to an ad valorem rate of duty, or to a rate of duty based in whole or in part upon the value thereof, which shall be dutiable at the rate applicable to their contents), shall be subject to duty as follows: If holding more than one pint, 1 cent per pound; if holding not more than one pint and not less than one-fourth of one pint, 1½ cents per pound; if holding less than one-fourth of one pint, 50 cents per gross: Provided, That the terms "bottles," "vials," "jars," "ampoules," "demijohns," and "carboys," as used herein, shall be restricted to such articles when suitable for use and of the character ordinarily employed for the holding or transportation of merchandise, and not as appliances or implements in chemical or other operations, and shall not include bottles for table service and thermostatic bottles.

Par. 218. (b) Tubes (except gauge glass tubes), rods, canes, and tubing, with ends finished or unfinished, for whatever purpose used, wholly or in chief value of glass, 65 per centum ad valorem; wholly or in chief value of fused quartz or fused silica, 40 per centum ad valorem; gauge glass tubes, wholly or in chief value of glass, 55 per centum ad valorem.

(d) All glassware commercially known as plated or cased glass, composed of two or more layers of clear, opaque, colored, or semi-translucent glass, or combinations of the same, 60 per centum ad valorem.

(e) Bottles and jars, wholly or in chief value of glass, of the character used or designed to be used as containers of perfume, talcum powder, toilet water, or other toilet preparations; bottles, vials and jars, wholly or in chief value of glass, fitted with or designed for use with ground-glass stoppers, when suitable for use and of the character ordinarily employed for the holding or transportation of merchandise; all the foregoing produced by automatic machine, 25 per centum ad valorem; otherwise produced, 75 per centum ad valorem. For the purposes of this subparagraph no regard shall be had to the method of manufacture of the stoppers or covers.

(g) Table and kitchen articles and utensils, composed wholly or in chief value of glass, when pressed and unpolished, whether or not decorated or ornamented in any manner or ground (except such grinding as is necessary for fitting stoppers or for purposes other than ornamentation), whether filled or unfilled, or whether their contents be dutiable or free, 50 per centum ad valorem.

(i) For the purposes of this Act, bottles, vials, and jars with glass stoppers or covers shall with their stoppers or covers be deemed entireties.

(j) For the purposes of this schedule an article shall be considered to be composed wholly or in chief value of glass if such article is wholly or in chief value of glass, or of paste, or of a combination of glass and paste.

Par. 230. (a) Stained or painted glass windows, and parts thereof, not specially provided for, 60 per centum ad valorem.

(b) Glass mirrors (except frames or cased mirrors in chief value of platinum, gold or silver), not specially provided for, not exceeding in size one hundred and forty-four square inches, with or without frames or cases, 50 per centum ad valorem.

(c) Glass ruled or etched in any manner, and manufactures of such glass for photographic reproductions or engraving processes, or for measuring or recording purposes, 55 per centum ad valorem.

(d) All glass, and manufactures of glass, or of which glass is the component of chief value, except broken glass or glass waste fit only for remanufacture, not specially provided for, 50 per centum ad valorem.

Par. 231. Smalts, frostings, and all ceramic and glass colors, fluxes, glazes, and enamels, all the foregoing, ground or pulverized, 30 per centum ad valorem; in any other form, 40 per centum ad valorem; opal, enamel or cylinder glass tiles, and tiling, 40 per centum ad valorem.

The Cost of a Modern Glass Factory

Glass manufacturers will find the accompanying chart useful for determining approximately the cost of a new factory building.

Simply zigzag two straight lines across as indicated by dotted lines and the answer is instantly found in column D.

For example, if the height of the factory is to be 12 ft., find that height in column A. If the length is to be 200 ft., find that length in column B. Then run a straight line through the 12, column A, and the 200, column B, and locate the intersection in column C. Then from the located point in column C run over to the width, column E. Thus if the width is to be 100 ft. the intersection of the line with column D gives the answer as about $53,000, for first class construction.

As will be noted the adaptability of this chart is very great, column A varying from 7 to 60 ft. in height. The length, column B, varies from 6 ft. to 500 ft. and the width, column E, varies from 10 ft. to 300 ft. The costs included vary all the way from $1,000 to $200,000.

In developing the chart is was assumed that reinforced concrete would be used with flat slab ceilings and without beams or girders. The construction permits uninterrupted distribution of light and low cost installations of sprinkler equipment, shafting, and the like.

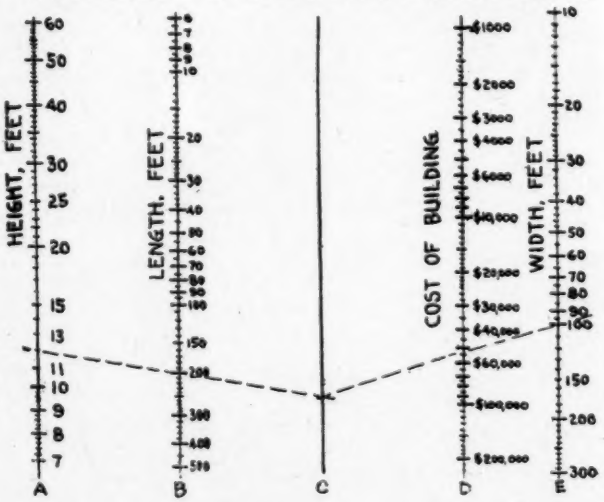
Usually ceilings are about 12 ft. high and columns about 20 ft. apart. A factory 60 ft. high is unusual, of course. Floors are generally designed to sustain a working load of 125 lb. per sq. ft. and are finished with cement.

It is also assumed that factory-type steel windows will be used. These, with ventilating units, will fill about 50 per cent of the wall area. This sort of construction insures plenty of daylight and air. Inside walls are usually cold water painted. If particularly good illumination is wanted, oil paint is generally used instead of cold water. The average for artificial illumination is one watt per square foot of floor space.

A steam heating plant is also provided for in the basement and wall-type radiators, located beneath the windows, used. These are designed to maintain a temperature of 70 degrees F. inside the building during zero weather.

For sprinkler equipment it is common to allow one head for each 90 sq. ft. of floor area. The plumbing varies with the number of employees and with state and municipal requirements. Partitions generally are of hollow tile, 4 to 6 inches thick.

Regarding elevator equipment, our best construction engineers generally allow one 3,000 lb. capacity car for each 100 x 100 ft. building. Two cars are allowed for a 100 x 200 ft. building.



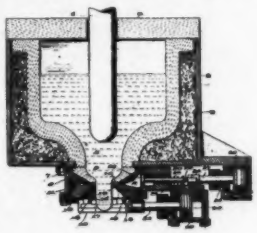
The first floor is usually about 4 ft. above the ground. This makes it easy to unload from box cars which are about 4 ft. 2 in. above the rail tops. Also this makes it easy to load trucks which are usually about 3 ft. 8 in. above the surface of the ground. Permanent provision is also allowed for protecting trucks and cars during the loading process.—*W. F. Schaphorst.*

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

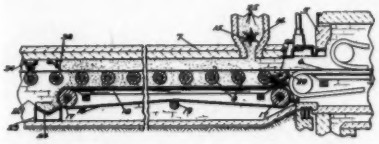
Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C., Price 10c each

METHOD AND APPARATUS FOR SEVERING MOLTEN GLASS. U. S. 1,748,550. Feb. 25, 1930. George R. Haub, Washington, Pa., assignor to Hazel-Atlas Glass Co., Wheeling, W. Va. Filed 7/29/27.



A method of severing charges of molten glass which includes flowing the glass through an outlet, and intermittently directing a thin stream of explosive gases radially against the surface of the glass, thereby igniting the gas and severing the glass. Claimed possible by a flow spout having an outlet, a chamber for an explosive fluid surrounding said outlet, said chamber comprising an annular upper wall, a cylindrical side wall, an annular lower wall reciprocably mounted within said cylindrical wall and having gas-tight engagement therewith, means normally holding said lower wall at the upper limit of its movement, means for periodically admitting an explosive fluid to said chamber, and means synchronized therewith for releasing the lower wall and for returning it to its normal position.

METHOD AND APPARATUS FOR ANNEALING SHEET GLASS. U. S. 1,748,116. Feb. 25, 1930. John L. Drake, Toledo, O., assignor to Libbey-Owens Glass Company, Toledo, O. Filed 5/19/27.

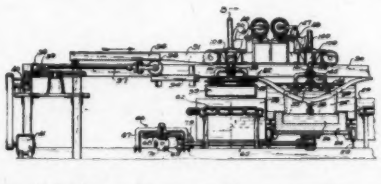


An apparatus for annealing sheet glass, a lehr for receiving a moving sheet to be annealed, and substantially solid means surrounding the moving sheet and contacting therewith within the lehr for preventing a too rapid cooling thereof.

Also in an apparatus for annealing sheet glass, a lehr for receiving a moving sheet to be annealed, and a powdered material surrounding the moving sheet and contacting therewith within the lehr for preventing a too rapid dissipation of the heat therefrom.

APPARATUS FOR PRODUCING MOLD CHARGES. U. S. 1,738,479. Dec. 3, 1929. William J. Miller, Swissvale, Pa., assignor to Hartford-Empire Company. Filed 3/20/26. An invention relating to automatic feeders for producing a succession of mold charges of molten glass, and comprises certain new improvements in the mounting of and in the means for imparting movement to the rigid implements employed to control the discharge of the glass from the outlet of the feeder receptacle, in the means for regulating and adjusting the positions and movements of said implement, and in the combined mold charge-guide and cullet chute.

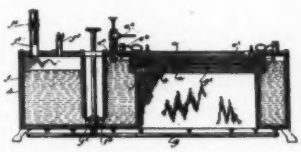
PROCESS AND APPARATUS FOR PRODUCING SHEET OR PLATE GLASS. U. S. 1,748,115. Feb. 25, 1930. John L. Drake, Toledo, O., assignor to Libbey-Owens Glass Company, Toledo, O. Filed 3/31/26. An apparatus for producing sheets of glass, comprising a receptacle containing molten glass,



means for longitudinally indexing said receptacle, a plurality of annealing lehrs in close proximity thereto, a carriage elevated above said receptacle and lehrs, a plurality of members attached to said carriage, means for alternately dipping said members in the molten glass, means for forming sheets of glass, in said members, from said molten glass, reciprocatory means for conveying the sheets thus formed to their respective lehrs, means for removing said sheets from said members, and means for feeding said sheets into said lehrs.

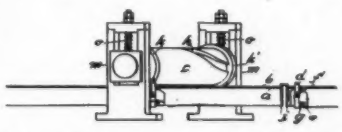
SHEET-GLASS SURFACING APPARATUS. U. S. 1,748,112. Feb. 25, 1930. Joseph P. Crowley, Toledo, O., assignor to Libbey-Owens Glass Co., Toledo, O. Filed 1/7/26. A runner construction for use in machines for polishing flat glass, including a rotatable runner frame, an outer annular series of polishing blocks carried by said frame and being of a uniform size, a second annular series of polishing blocks carried by the frame inwardly of the first series and being of a plurality of sizes alternately arranged, a third annular series of polishing blocks carried by the frame inwardly of the second series and being also of different sizes alternately arranged, and a fourth annular series of polishing blocks carried by said frame inwardly of the third series and being of a uniform size, the larger and smaller polishing blocks of the second and third series being of substantially the same sizes respectively and all smaller than the blocks of the first series and the blocks of the fourth series being of substantially the same size as the smallest blocks of the second and third series.

SEALING LAMINATED GLASS AND APPARATUS THEREFOR. U. S. 1,746,826. Feb. 11, 1930. Thomas H. Powers Fare, Jr., New York, assignor to Triplex Safety Glass Company of North America. Filed 4/3/28.



An invention to provide for the rapid and effective introduction of the sealing material or compound into the sealing slot after the formation of the compound sheet has been completed and the sealing slot has been cleared out. In accordance with the invention the compound or laminated sheet, with the sealing slot cleared out, is subjected to a vacuum for the purpose of reducing as low as practicable the pressure in the sealing slot and the sealing material, maintained in a fluid condition by heat, is then permitted to fill the sealing slot, while the pressure in the slot is at a minimum, pressure being applied also to the sealing material if necessary to aid the flow of the sealing material into the slot. Under the influence of the vacuum and of the capillary action of the very thin sealing slot the sealing material fills the slot to the bottom. The character of the sealing material is such that it chills and hardens quickly by contact with the relatively cooler glass so that the glass can be removed immediately without loss of sealing material from the sealing slot.

DEVICE FOR CUTTING SHEET GLASS. U. S. 1,747,270. Feb. 18, 1930. Lambert Von Reis, Herzogenrath, Germany, assignor by mesne assignments to The American Bicheroux Company. Filed 8/28/28 and in Germany 9/1/27.

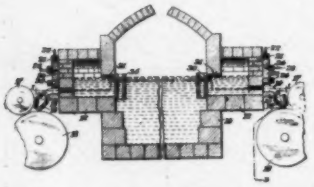


An invention for cutting sheet glass in plastic condition while being carried ahead. A device comprising a knife which is rotatable around a horizontal axis extending transversely of the sheet to be cut.

The invention has for its object to provide a device of the kind stated in which the blade of the rotatable knife is arranged along a helical line around the axis of rotation and designed to coact with rectilinear cutting blades arranged on the glass support. The cut is performed gradually from one side edge of the glass sheet to the other so that sheets of any desired thickness may be severed with a minimum expenditure of power and without subjecting the blades to considerable stress. Cutting operations may be effected without stopping the movement of the conveyor. In this case, the most preferable cut, that is a cut extending at a right angle to the side edges of the sheet may be obtained by arranging the cutting blades of the conveyor at a right angle to the side edges thereof and the rotary main knife at such an angle with relation to the straight cutting blades that its helical blade unrolls along the

straight cutting blades when rotated at a speed corresponding to the speed of the conveyor. The conveyor itself produces the rotation of the knife by the frictional engagement of its cutting blades with the helical cutting blade, no special means being therefore required for rotating the knife.

APPARATUS FOR FORMING SHEET GLASS. U. S. 1,749,332. March 4, 1930. Nicklas Franzen, Long Beach, Calif., assignor to Mississippi Glass Co. Filed 4/7/26.



A glass melting and sheet forming apparatus, in combination, a melting furnace, outports in the walls of said furnace below the normal levels of molten glass therein, a baffle in the path of flow of glass from the furnace to said ports having an open end trough extending from a point on the side away from said port and below the normal levels of molten glass therein, an opening on the port side of the said baffle at a point within said levels of molten glass in said furnace, a plurality of troughs communicating with said ports, a longitudinal funnel for receiving molten glass from the said plurality of troughs and having its lower and outgoing opening of dimensions approximating the cross sectional dimensions of the sheet glass to be made and forming means for receiving the stream of molten glass from the said funnel.

GLASS AND METHOD OF PRODUCING IT. U. S. 1,749,823. March 11, 1930. Bernard Long, Paris, France, assignor to Societe Anonyme des Manufactures des Glaces & Produits Chimiques de Saint-Gobain, Chauny & Cirey, Paris, France. Filed 6/14/28 and in France 7/2/27. A glass resulting from the cooling of a melted mixture containing phosphoric acid, or phosphoric and boric acids, and salts of the alkaline earths, or alumina (as distinguished from a silicate glass) titanium dioxide gives the glass, when it has been properly melted, a very pure violet color. The transmission of such a glass is such that when a layer of it is associated, as in a doubtlet, with a layer of silica glass having the usual green tint (due to oxide of iron contained therein) a screen is produced having nearly uniform transmission for the whole of the visible spectrum, and of a neutral grey tint.

The following are suitable batches for such glasses:

	1	2
Phosphoric acid (60° Baumé)	76.1	59.4
Boric acid	...	18.7
Di-calcium phosphate ($CaHPO_4$) (49% CaO)	45.7	...
Magnesium phosphate, hydrated ($Mg_3(PO_4)_2.7H_2O$) (losing 36% on ignition)	11.4	45.5
Aluminium phosphate ($AlPO_4$) hydrated (losing 27.2% on ignition)	...	30.1
Titanium oxide	2.0	1.6

To the above are added a sufficient quantity of the carbonaceous reducing agent, effective to cause the melting to take place under reducing conditions.

WINDOW GLASS OR THE LIKE. U. S. 1,748,587. Feb. 25, 1930. Anderson B. Smedley, Cincinnati, O. Filed 5/2/27. A glass for window lights and other glass articles comprising three layers of glass, the two outer layers being of clear transparent glass having smooth outer surfaces, the center layer being translucent and permeated with bubbles, and a heat insulating and light diffusing agent, air and gas, filling the bubbles.

LAMINATED GLASS AND PROCESS OF PRODUCING THE SAME. U. S. 1,748,079. Feb. 25, 1930. James W. H. Randall, N. Y., assignor to Libbey-Owens Glass Co., Toledo, O. Filed 11/17/27. The process of producing laminated glass consisting in applying a film of rubber cement to one side each of two sheets of glass, allowing the films to become substantially dry, then interposing a cured rubber sheet between the rubber cement coated glass surfaces and uniting the same.

TRANSLUCENT LAMINATED GLASS AND PROCESS FOR MAKING SAME. U. S. 1,748,080. Feb. 25, 1930. Joseph A. Reece, Toledo, O., assignor to Libbey-Owens Glass Company, Toledo, O. Filed 4/30/26. A method of producing laminated glass, consisting in creating a relatively roughened surface on one side only of two sheets of glass, arranging the glass sheets at opposite sides of a sheet of non-brittle material in a manner that the roughened surfaces are positioned outwardly and the smooth surfaces inwardly, and in then uniting the glass sheets to the sheet of non-brittle material to form a composite structure.

MANUFACTURE OF GLASS SHEETS. U. S. 1,749,798. March 11, 1930. Louis Boudin, St. Gobain, France, assignor to Societe Anonyme des Manufactures des Glaces & Produits Chimiques de Saint-Gobain, Chauny & Cirey, Paris, France. Filed April 8, 1927 and in France April 15, 1926.

Patent Litigation

Hartford-Empire Company, Hartford, Conn., has begun a suit at Baltimore, Md. against the Carr-Lowrey Glass Company of that city alleging infringement of patent No. 1,212,189 issued to C. F. Cox, January 16, 1917, covering a method for gathering glass.

In the suit of the Hartford-Empire Company vs. Hazel Atlas Glass Company alleging infringement of Peiler glass feeder patent No. 1,655,391 in the District Court of the United States for the Western district of Pennsylvania, Judge Gibson handed down the decision that the patent was not infringed by the defendant and dismissed the plaintiff's bill of complaint. It is stated that the plaintiff will appeal the case.

Alleging infringement of patent No. 1,603,989 issued to Lee Showers and covering a process of making sheet glass, the Pittsburgh Plate Glass Company, to whom the patent was assigned on October 19, 1926, and owners also of the reissued patent No. R 16,755 of October 4, 1927, have begun an action against the National Plate Glass Company in the U. S. District Court, at Baltimore, Md. A preliminary injunction against the defendant and eventually a permanent injunction is requested by the plaintiff.

The Hartford Empire Company's infringement suit against the Obear-Nester Glass Company, St. Louis, Mo., which was in the courts over a year ago and on which judgment was given by Federal Judge Faris to the effect that some of the patent claims were invalid and that others had been infringed by the defendant was affirmed by the U. S. Circuit Court of Appeals at St. Louis, Mo., on February 25, 1930. Both sides have appealed from Judge Faris' decision.

Awards to General Electric Employes

Out of the 70,000 employes of the General Electric Company, 37 who during 1929 saved money for the company or contributed to its efficiency in an unusual degree have been given awards under the Charles A. Coffin Foundation. The awards in each case consist of a certificate of merit and a substantial sum of money. Many of the men made suggestions which mean a definite annual saving to the company. In nine cases these savings have been estimated, and the total figures up to more than $1,250,000 per year.

The recipients of these awards come from various branches of the company's organization. By far the larger number—24—is made up of factory workmen or foremen. The proportion of employes of this class is somewhat higher than in previous years. Ten of the recipients are engineers or laboratory men, and the other three are commercial men.

The achievements of these men are mostly technical in character, but each is an instance of ingenuity, skill, and perserverance. One man developed the use of a higher grade of paper in the manufacture of a certain product and carried the development to a point where the new process was more efficient than the old and was still as profitable commercially. Another brought about close co-operation and co-ordination of effort on a particular task between divisions of General Electric and its affiliated companies. Another suggested a method which made the job in question easier and at the same time speeded it up more than 280 per cent. Still another was a factory man who filed over 50 suggestions in the first 10 months of 1929. One man succeeded in having a three months' college course in electrical illumination for post-graduate students established at a prominent college and personally conducted the lectures in addition to performing his regular work. Another man had seven of his suggestions adopted in 1929, while four others are under consideration.

The Charles A. Coffin Foundation was created in 1922 upon the retirement of the late Charles A. Coffin, the company's founder.

French Glass Group Will Arrive in April

Arrangements have been made for the entertainment and it is hoped, the enlightenment on American glass making and ceramic manufacturing methods, of a party of French glass and clay industry representatives who will arrive in New York on April 8 to make a two-weeks tour of glass manufacturing and clay working plants in this country. From fifteen to twenty guest are expected, about equally divided between the two industries.

Suggested itineraries for both the glass and clay sections of the party have been arranged by Ross C. Purdy, general secretary of the American Ceramic Society and Prof. George H. Brown, secretary of the New Jersey Clay Workers Association. The French visitors will be the guests of that Society while in New Jersey. Traveling arrangements have been made by Raymond and Whitcomb Company, Boston, Mass.

Upon arrival in New York at the French Line pier on Tuesday, April 8, the party will be taken to the Hotel Pennsylvania where suitable accommodations have been arranged for. If the arrival occurs at a sufficiently early hour a comprehensive sight-seeing motor tour of uptown and downtown New York will be provided.

The Glass Group

Next day, Wednesday, April 9, a visit of the glass group to the New York laboratories and offices of the Glass Container Association of America will be made. In the evening the party will proceed to Philadelphia and be located at the Benjamin Franklin Hotel.

On Thursday morning, April 10, while the clay group begin their visits to ceramic plants in New Jersey, the glass group will leave Philadelphia for Bridgeton, New Jersey, by motor car, stopping at the Cumberland Hotel for luncheon, after which visits will be made to the Illinois Glass Company's plant at Bridgeton and the Vineland Flint Glass Company at Vineland.

On Friday, April 11 they will remain in Vineland and Millville visiting the Kimble Glass Company at Vineland, the Whitall-Tatum Company, T. C. Wheaton Company and Millville Bottle Works at Millville, New Jersey as well as the Tavern Rock Sand Company's plant, and will return to the Benjamin Franklin Hotel, Philadelphia, for the night.

Early Saturday morning, April 12, the party will go by railroad to Baltimore, Maryland, and visit the Carr-Lowrey Glass Company, Swindell Bros., and Buck Glass Company manufacturing plants. Late that afternoon they will go on to Washington, D. C. and will spend Sunday sight-seeing. The party will be quartered at the Mayflower Hotel, where they will be joined by the ceramic group which meantime will have completed their trip through the clay plants of New Jersey. Both groups will follow the same Washington program. There are no industries at Washington for them to inspect, the city being entirely a governmental and residential locality.

On Sunday morning, April 13 the visitors will be taken by motor coach through the business and residential sections of the city viewing all of the public buildings and other points of interest. In the afternoon a coach trip will be provided to the Arlington National Cemetary where America's tomb of the Unknown Soldier will be visited. Leaving Washington that evening, the party will arrive at Pittsburgh early Monday morning, April 14, and visit the H. L. Dixon Company and the United States Glass Company plants. Breakfast and luncheon will be served at the William Penn Hotel. In the afternoon a motor trip will be taken to Washington, Pennsylvania, and the party will be located that night at the George Washington Hotel.

On Tuesday, April 15 the plant of the Simplex Engineering Company and the Washington plants of the Hazel-Atlas Glass Company and refractory works of the Findlay Clay Products Company will be inspected and the party will then return by rail to Pittsburgh and from there go to Columbus, Ohio, arriving early Wednesday morning, April 16.

Breakfast, luncheon and dinner will be provided at the Deshler-Wallick Hotel. The ceramic tourists will be in Columbus at the same time. Visits will be made to the American Ceramic Society, the Ceramic Department of Ohio State University, Standard Pyrometric Cone Company, Federal Glass Company, Miller Machine and Mold Works, the Buckeye Window Glass Company and the Berney-Bond Glass Company's bottle plants. From Columbus, on Wednesday evening, the party will proceed together with the ceramic group to Toledo, Ohio, arriving early Thursday, April 17. Breakfast and luncheon will be at the Commodore Perry Hotel. Visits will be made to the Libbey Glass Manufacturing Company, Libbey-Owens Glass Company, Buckeye Clay Pot Company, and the Toledo Mould Company. The party will then go on to Detroit, arriving there on the evening of April 17.

On Friday, April 18 the party will be taken by motor coach to the Ford automobile plant at Dearborn, Michigan, where mass production of automobiles will be observed including the continuous sheet glass making process first developed by the Ford Motor Company and the making of the non-scatterable glass used in Ford automobiles.

On Saturday morning, April 19 a sight-seeing trip will be made through the residential sections of the city and the city's Detroit River resort, Belle Isle. The afternoon will be free for independent action.

Leaving Detroit on Saturday both groups will sail eastward on a steamer of the C. & B. line the entire length of Lake Erie arriving at Buffalo on Sunday morning, April 20. The Statler Hotel will be their headquarters. A trip to Niagara Falls by motor coach will include a complete itinerary of the world famous district including the Falls, gorge of the Niagara River, the whirlpool and the rapids.

An over-night stop at the hotel in Buffalo, after returning from the Falls trip, will be made and on Monday, April 21, the glass group will leave Buffalo via Delaware, Lackawanna & Western Railroad at 9:30 A. M. and arrive at Corning, New York at 12:21 P. M. They will proceed to the Baron Steuben Hotel and then visit the Corning Glass Works, Steuben Division. The party will remain over in Corning until 12:21 P. M. the next day, April 22, and then return to New York arriving at the D. L. & W. station Hoboken, New Jersey at 7:12 P. M. and the 33rd Street and Broadway station of the Hudson Tubes at 7:28 P. M., one block from their headquarters at the Pennsylvania Hotel. At 11 A. M. on Wednesday, "good-byes" will be said and the party will be conveyed to the French Line pier and sail on the SS "De Grasse" to their home port.

The Clay Group

The day after their arrival at New York on Wednesday, April 9, those visitors interested in clay products will go under the Hudson River through the Holland Tunnel to Woodbridge, New Jersey, and continue on to Perth Amboy where ceramic plants will be inspected and then to New Brunswick where a visit to the ceramic department of Rutgers University will be made. The party will stay overnight at the Woodrow Wilson Hotel.

From that point on visits will be made to ceramic plants at Sayreville and Trenton, N. J., Baltimore, Md. A sight-seeing trip will be taken to Washington and the party will then go to Pittsburgh, inspect plants in Western Pennsylvania, Ohio, at Detroit, and Buffalo, view Niagara Falls, leave Buffalo for New York and on Wednesday, April 23 sail, along with the glass group, for their homes abroad.

Representatives of the glass and ceramic industries of France who had already registered by February 25 their intentions of taking the tour are reported by M. Jean Milhand of the Confederation Generale de la Production Francaise as follows:

Glass Group

MM Paul Haviland, Directeur de la Maison Lalique.
Thouvenin, Directeur de la Verrerie de Vierzon.
Fournier, Ingenieur a la Verrerie de Vierzon.
Godfroy-Rouillion, Directeur de la Verrerie Godfroy-Rouillion a Vierzon.
Charbonneaux, Directeur de la Verrerie de Reims.
Favre, Administrateur-Delegue de l'Union Verriere.

Pottery Group

MM Le Heron, Administrateur des Establissements Porcher.
Fourmaintraux, Directeur des Etaolissements Ceramiques Fourmaintraux et Delassus.
Edouard Fenal, Gerant de la Faiencerie de Badonviller Administrateur delegue des Fainenceries de Luneville.
V. Sanson, Directeur des Etablissements Sanson.
Guido-Gerster, Administrateur Delegue de la Societe Anonyme pour l'Industrie Ceramique a Laufon (Suisse).

The Glass World and What It Is Doing

News of the Industry

Libbey-Owens and Edward Ford Companies to Merge

Announcement was made on March 28 at Toledo, Ohio, of an agreement reached by the boards of directors of the Edward Ford Plate Glass Company and the Libbey-Owens Glass Company, both of Toledo, to merge their interests in a new company under the name Libbey-Owens Ford Company.

The new concern, it is reported, will equal or exceed in capitalization and importance that of the combined Owens Bottle and Illinois Glass Companies in the bottle manufacturing field last year. Negotiations have been under way several months. It is understood that common stock of Libbey-Owens will be given in payment.

The new company will be the largest manufacturer of sheet glass and one of the largest of plate glass in the world, as well as a very important factor in the laminated glass field. J. C. Blair of Toledo, president of Libbey-Owens, will continue at the head of the new company. The Libbey-Owens directors will be on the enlarged board. The new members will be John D. Ford of Detroit and George R. Ford and G. P. MacNickol Jr. of Toledo.

The Libbey-Owens company was organized in 1916 by the late Edward Drummond Libbey and Michael J. Owens. Its securities, listed on the New York Stock Exchange, have a valuation of $50,000,000. It has five plants in the United States and is affiliated with nine glass plants abroad.

The Edward Ford Plate Glass Company was organized in 1899 by the late Edward Ford, whose father, Captain John B. Ford, was the first successful manufacturer of glass in this country.

Libbey-Owens Glass stock was reported on Saturday, March 29 as closing on the New York Stock Exchange at 28, after sales during the day of 4,100 shares at prices ranging from 27½ to 28⅜, a new high record for 1930.

Completed Clay Products Census for 1928

The completed Government census of the clay products industries covering clay products (other than pottery) and non-clay refractories, pottery and sand lime brick, give the following figures for the year 1928:

Glasshouse Tank Blocks, Melting Pots, Stoppers, Floaters, and Rings, 1928.

Number of establishments—13, quantity produced—35,513 tons, value—$1,993,609; stocks on hand, December 31, 1928, 21,828 tons. This compares with the 1927 figures as follows:

Number of establishments—14, quantity produced—41,177 tons; value—$2,310,473; stocks on hand, December 31, 1927, 23,647 tons.

Of the total production of glass house tank blocks, melting pots, stoppers, floaters and rings in 1928, five plants in Pennsylvania produced 7,657 tons valued at $536,850. Stocks on hand December 31, 1928 amounted to 6,488 tons. The balance of the total production came from 8 factories in California, Indiana, Kentucky, Missouri, New Jersey and Ohio. The quantity produced was 27,856 tons valued at $1,456,759. Stocks on hand at these plants on December 31, 1928, amounted to 15,340 tons.

Silica Brick—The production of silica brick in 1928 by the 26 establishments reporting amounted to 241,523 thousands valued at $12,187,539. The stocks on hand December 31, 1928 amounted to 48,846 thousands.

In 1927, 27 establishments produced 245,881 thousands of silica brick valued at $12,756,994. Stocks on hand December 31, 1927 were 56,876 thousands. In 1926, thirty-one plants produced 266,409,000, valued at $13,614,033. Stocks on hand December 31, 1926 were 51,114 thousands.

Of the total production of silica brick in 1928, $8,332,349 worth was produced in Pennsylvania, $3,324,639 worth was produced in Alabama, Illinois, Indiana, Missouri and Ohio, and $530,551 worth was produced in California, Colorado, Montana and Utah.

Demands Wider Use of Non-Scatterable Glass

State Senator D. T. O'Brien, it is announced, will introduce a bill into the New York State Legislature requiring that all public vehicles with windows be equipped with laminated (safety) glass. He stated that while accidents from all causes decreased 20% from 1913-1921, automobile accidents increased 195% and from 1921-1927 the death rate from accidents caused by motor vehicles increased 71%. Such accidents are more than double those occurring in any other manner. The Senator emphasized the fact that it is time for the citizens of the State to wake up and adopt preventative measures.

In the City of New York, Police Commissioner Whalen a few weeks ago issued an order that after February 15, 1930, all new taxicabs put into use must be equipped with Duplate scatterproof glass side, partition and rear windows. The glass must be free from air bubbles, cracks and fractures and be set in frames of approved quality and so fitted as to be noiseless. Cincinnati and other cities have taken somewhat similar action and it seems to be only a question of time when operators of all public and semi-public conveyances will be required to protect the public as far as possible with safety glass. A Canadian railroad has already equipped observation cars with safety glass and predictions have been made that all new railroad, subway, surface and elevated cars will eventually have to adopt this "safety first" practice.

R. F. Brenner Joins R. & H. Service Staff

The Roessler & Hasslacher Chemical Company, New York, announce R. F. Brenner will join their Service Staff for the glass industry. Mr. Brenner's training and past experience fit him thoroughly for this post.

Mr. Brenner graduated from the University of Pittsburgh with a B.S. degree as a Chemical Engineer and Glass Technologist. His first position was with the H. C. Fry Glass Company at Rochester, N. Y. During the war he served in the Army. Returning to commercial pursuits, Mr. Brenner joined the Vitrolite Company, Parkersburg, W. Va., and followed this with a term of service at the Torrance Flat Glass Company in California. For the last four years Mr. Brenner has been chief chemist of the Owens group.

Mr. Brenner's headquarters will be at Toledo, O., from which central location he will be in close touch with the trade. His many friends will wish Mr. Brenner success in his new connection.

Black Light

Speaking on "Medico-Legal Uses of Filtered Ultraviolet or Black Light," Dr. Herman Goodman demonstrated and explained some of the many innumerable ways in which the longer, or near, rays of ultraviolet light can be used in medical, legal and chemical investigations. Traces of fluorescent materials, invisible in ordinary light but brilliantly glowing when subjected to long wavelength ultraviolet light can be used in many ways to prevent and to detect crime, Dr. Goodman pointed out.

The presence of such a tiny amount as one in five million parts of a certain material in industrial alcohol is sufficient to offer a means whereby the diversion of such alcohol for bootleg liquor can be detected, said Dr. Herman Goodman in a talk before the Society of Medical Jurisprudence at a meeting in the Academy of Medicine Building recently.

One source of the near ultraviolet or black light used by Dr.

Goodman in his demonstrations was a Cooper-Hewitt low pressure mercury vapor lamp, supplied by the General Electric Vapor Lamp Company of Hoboken. Instead of the usual glass tube, used when the lamp is intended as a source of ordinary light, or the quartz tube used when the lamp is intended as a source of short, or far, ultraviolet radiation, the lamp used by Dr. Goodman was made of a dark blue-black glass. This glass, containing nickel and cobalt, is opaque to both the visible light to which glass is transparent and the far ultra-violet to which quartz is transparent. It is, however, transparent to the near ultraviolet, or longer wave lengths than the middle ultraviolet, found in sunlight and produced by health lamps, and the short or medial wave lengths. Since the light to which the human eye is sensitive is cut off by the blue-black nickel-cobalt glass, this emission has come to be known as black light. Such tubes have been used in spectacular theatrical illumination work, but have not been applied commercially otherwise.

Construction Figures for the Month of February

Building and engineering contracts awarded in the 37 states east of the Rocky Mountains reached a total of $317,053,000, according to F. W. Dodge Corporation. The territory covered by these records includes approximately 91 per cent of the total construction volume of the country. Compared with the January, 1930, total of $323,975,200 there was a decrease of only 2 per cent; and February, 1929, was 12 per cent below January, 1929. The first three weeks of last month had very low contract records, but this was offset by a very sizeable increase in the closing week of the month, indicating the beginning of the normal spring revival of construction operations. The February, 1930, total was 12 per cent under that of February, 1929. Since January of this year fell 21 per cent below the January, 1929, the February record is an indication of improvement. Total contracts awarded during the first two months of this year have amounted to $641,028,200 being a decrease of 17 per cent from the first two months of last year.

British Foundry to Manufacture American Product

King-Taudevin & Gregson Ltd., Melbourne Chambers, Cambridge Street, Sheffield, England have made an arrangement with H. L. Dixon Company, Pittsburgh, Pa. to manufacture Dixon improved vanad iron for sale in England and on the Continent. This long established English foundry, well known to the glass manufacturers of Europe, came all the way to the Dixon plant at Carnegie, Pa. to find out how this iron was made. As a result of their representative's visit it developed that owing to lower labor costs in England the same iron can be made there and sold in Europe on a satisfactory basis whereas high American labor costs prohibit exportation on a large scale from this country.

DeVore Company Absorbed by Ferguson

The H. K. Ferguson Company, engineers and builders, Cleveland, O., reports that it has taken over The DeVore Company of Toledo, Ohio, for many years specialist in glass plant and paper mill layout and design.

H. C. Van Tine, president of The DeVore Company, will join The H. K. Ferguson Company about April 1 as contract engineer and consultant in the design of glass and paper factories. For fifteen years The DeVore Company handled the design of all plants in the United States and Canada for the Libbey-Owens Glass Company, and for a similar period served The Mid-West Box Company, and its successor, the Container Corporation of America.

Other glass plants designed by the Toledo organization include the Edward Ford Plate Glass Company at Toledo.

Westinghouse Radio Salute to The Glass Industry

"The Romance of Glass," one of a series of Westinghouse broadcast programs was sent through the air on Tuesday eveing, March 18, and responded to by E. J. Barry, president of the National Association of Pressed and Blown Glass Manufacturers, over a coast-to-coast network of NBC, including Westinghouse Stations KDKA, WBZ, WBZA and KYW, and against a background of colorful and impressive music.

Mr. Barry Spoke of the growing use of glass which provides us with many useful, interesting and indispensable products.

February Production of Polished Plate Glass

The United States production of polished plate glass for the month of February, 1930, was 9,804,464 sq. ft., as compared with 10,017,909 sq. ft. produced in the preceding month, January, 1930, and 11,289,396 sq. ft. produced in the corresponding month last year, February, 1929. These are the figures compiled by P. A. Hughes, Secretary of the Plate Glass Manufacturers of America.

Trade Activities

Chicago's Great Merchandise Mart, claimed to be the world's largest building, will open to the buyers of the world May 1, according to an official announcement by C. A. Welles, general manager of the enterprise. More than 600 manufacturers of merchandise are represented in the list of tenants including numerous glassware manufacturers and distributors. The entire wholesale department of Marshall Field & Company will be moved into the building before the opening date. Four floors equivalent to 20 acres of space will be occupied by this organization. Glassware exhibits, lamps, mirrors and china will be located on the fifteenth floor. On the second floor is a big exhibition hall. All conveniences for transacting business are provided on the main and other floors. The radio broadcasting studios of the National Broadcasting Company will be located on the 19th or 20th floors. The Merchants Club will have quarters in the tower and at the top of the tower a convention hall is provided in which to hold conferences and meetings. The erection of the building is considered an extraordinary feat more than 2,500 members of all the building crafts whose faces and speech reflect every nation that has contributed men to America, the largest number ever used at any one time on any building project in the United States were employed. The building contains 5,500 windows requiring 132,000 square feet of glass, 30,000 lighting fixtures, 35,000 electric lamps. The outside dimensions of the building are 296 feet on Franklin and Orleans Streets, 326 feet on Wells Street, 573 feet along the north bank of the Chicago River and 724 feet on Kinzie Street.

The Glass Container Association of America is sponsoring a nation-wide glass-packed product window display contest which has aroused much enthusiasm among the packers, jobbers and retail merchants who produce and sell such products. A grand prize of $1,000 has been offered which will be awarded regardless of the size and extent of the display, making it possible for the small dealer to compete with the entire field. Sixteen additional district prizes of first, $200; second, $100; third and fourth, $50; fifth to eighth, $25; and eight honorable mentions of $10 each are promised. Additional prizes totaling $1,870 for wholesalers, jobbers, and packers' salesmen who sponsor their company's displays are provided. The total cash awards in the contest amount to $8,840. The contest runs from April 1 to May 15. Philip I. Heuisler of the Maryland Glass Corporation, Baltimore, Md., and president of the Glass Container Association of America, is one of the judges in the contest.

The Southern Glass Company's plant on East 26th Street, Los Angeles, Cal., was badly damaged last month by a terrific wind storm which unroofed a large storage building in which about 100 employes were working, forcing them to seek safety as best they could. Several persons were picked up bodily and hurled a distance of 50 to 100 feet. Faye G. Bennison, general manager of the plant, estimates the damage done as close to $10,000. The roof of the storage warehouse was carried some distance before it crashed to the ground. The roof of the carton house was also lifted and a force of men was immediately put to work to get the structure under cover and prevent damage to the paper cartons stored therein. Mr. Bennison was just leaving the office when he saw the "twister" coming. It is reported that he threw himself to the ground and saved himself by clinging to a concrete foundation post. One of the workmen was blown against Edward A. Schenk, general superintendent of the plant, after which the latter was picked up and blown 75 feet along with the dismantled roof. His eyeglasses were broken but with the exception of a few minor cuts he was uninjured. Several other narrow escapes were reported. After damaging the glass

plant the "twister" leaped 10 blocks to McPherson Street where it almost demolished an auto top factory. It took the roof off the Crown motor carriage company plant and destroyed two automobiles standing in front of the factory.

The National Association of Manufacturers of Pressed and Blown Glassware held a meeting in Pittsburgh on March 18 and 19. All the old general and executive officers were re-elected including E. J. Barry, president, C. B. Roe, Vice-president, John Kunzler, secretary and treasurer, Charles L. Gaunt of the Indiana Glass Company, Dunkirk, Ind., was added to the executive committee; M. W. Gleason of Gleason-Tiebout Glass Company, Brooklyn, N. Y., was named a committee member. It was decided to hold the annual wage conference between the manufacturers and wage committees of the American Flint Glass Workers Union at Toronto, Ontario, early in the summer, probably during the convention of the Union which this year will be held in that city.

Harbison-Walker Refractories Company report to the stockholders for the year ended December 31, 1929 showed a net profit of $5,256,413, an increase of 19 1/10 per cent over the year 1928. Of this amount $1,893,462 was carried to surplus increasing that account to $8,992,502. In June 1929 the Harbison-Walker Securities Company was organized with a paid-in capital of $1,000,000 all of which is owned by the parent company. The purpose of the new organization is the handling of accounts of employes who have purchased common stock in the company on the deferred payment plan, formerly handled by the refractory company itself.

Owens-Illinois Glass Company, Toledo, O., in their annual financial statement on March 18 reported total manufacturing profits and royalties amounting to $9,397,955 which with miscellaneous income of $598,596 made a total income of $9,996,-551. Expenditures and various charges amounted to $5,040,-525 and $504,200 was reserved for estimated federal income taxes, leaving the profit as stated above. At the stockholders' meeting to be held April 16 at Toledo a detailed statement of the company's operations for the year and physical condition of the company's property will be submitted.

The Brookmire Economics Service, Inc. discussing business conditions in general, recently expressed the belief that lower prices are likely to come in the plate glass market unless overproduction is checked. This opinion is based largely on the reduction in the number of motor cars to be manufactured this year and the fact that as a large proportion of the four million or so cars to be manufactured this year will be of the Ford type, less glass per car will be required than for larger cars and consequently production will be affected.

The Edward Ford Plate Glass Company, Rossford, O., according to a report in the Toledo Blade states that their grinding and polishing departments which have been working on a curtailed schedule will again be in full production by the latter part of April. The rush of business in 1929 made it impossible to make needed repairs, but now the plant is being put into the best of condition and some of the departments will probably increase operations early in April.

The Clear-View Glass Company, Butler, Pa., with a manufacturing plant at Renfrew, Pa., will hold an adjourned meeting of the stockholders on May 19, 1930, at 10:30 A. M., for the purpose of approving or disapproving an increase in the capital stock of the company from $100,000 to $200,000. Also for approving or disapproving an increase in the common stock of no par value from 2000 shares to 4000 shares; also to elect a board of directors.

The Pittsburgh Plate Glass Company, Pittsburgh, Pa., recently announced that manufacture of glass at Charleroi, Pa. would be discontinued and the equipment removed from the Charleroi plant to Ford City. It is reported that the company will erect new buildings at Charleroi for the manufacture of cararra glass and other products. Some of the Charleroi employes have, it is said, already been transferred to Ford City.

The Rockford Plate & Window Glass Company, Rockford, Ill., at their annual meeting recently elected D. J. Ritter vice-president and Lawrence P. Robinson, Jr. secretary. Other officers are Wyatt MacGaffey, president, R. E. Youngquist, treasurer, E. R. Johnson, production manager. A remarkable increase in sales over the preceding year was reported for 1929.

The United States Glass Company, Pittsburgh, Pa., has issued their annual report to stockholders showing a net loss of over $113,957 during 1929. Earned assets at the end of the year were $1,726,237, current liabilities $978,307. President Edward E. Slick stated that the year was an unsatisfactory one because of uncertain demand for operations. Only 61% of plant capacity was operated during the year.

Western States Plate Glass Company, Salt Lake City, Utah, of which F. E. McCambridge, president and treasurer of the Middle States Bond and Investment Company, 818 Olive Street, St. Louis, Mo., is reported to have had plans prepared by H. L. Dixon & Company, Pittsburgh, Pa., for a glass plant proposed to be built at Salt Lake City at an estimated cost of $5,000,000.

C. C. Waldo, factory manager of the Southwestern Sheet Glass Company, Okmulgee, Okla., since the establishment of the plant there in 1919, has resigned and, with his family, will leave soon for the East. Mr. Waldo superintended the construction of the plant. He has been in the glass manufacturing business 30 years.

W. H. Lewis, according to information received from California, has again taken charge of the Brock Glass Company's factory at Santa Ana. The company, which manufactures door knobs and other specialties is said to have a large stock on hand and is operating its factory on a reduced production basis.

Jenkins Glass Company, Arcadia, Ind., was forced to cease operations recently due to a leak which developed in a tank. New equipment including electric machinery and air compressors will be installed while the old tank is being replaced with a new one. This work will require five or six weeks.

The Oil City Glass Bottle Company's plant at McClintockville, Pa., the construction contract for which was obtained by the Clarion Block Company, Clarion, Pa., was started on March 13. The building, it is said, will be 200 by 500 feet in size, of steel, brick and glass.

The Bristol Company, Waterbury, Conn., manufacturers of indicating and recording and other instruments, recently opened a new sales and service office in Los Angeles, Cal., where S. W. Case is the district manager and W. H. Rogers, sales and service engineer.

The Harshaw Chemical Company, Cleveland, O., recently removed their executive and sales offices to 1945 East 97th Street (telephone Cedar 6300). At the new location they occupy a large substantial stone building formerly used as a library.

The Capstan Glass Company, Connellsville, Pa., are erecting a carton factory which will be constructed by the Austin Company of Cleveland, Ohio. It is expected that speedy action by the contractor will result in completion about June 1.

The Interstate Window Glass Company, according to a report from the Mount Jewett (Pa.) Chamber of Commerce, has lighted fires in the tank at the local factory preparatory to beginning manufacturing operations at an early date.

The Pennsylvania Bottle Company's plant at Sheffield, Pa., early in February began preparations for the resumption of manufacturing operations by lighting the tank fires. Reconstruction of the tank had been completed recently.

The Pittsburgh Plate Glass Company according to a report originated in New York has acquired property at Mineola, N. Y., and will invest over $100,000 in a warehouse and distributing plant.

Morris DuBois recently was made president of the Imperial Glass Company succeeding G. W. Hannan of Wheeling, W. Va., vice-president of the Hazel-Atlas Glass Company, who resigned.

James Morrison, formerly vice-president of the Owens Bottle Company, recently resigned and has become connected with the Knox Bottle Company, Knox, Pa., as sales engineer.

Helios Concrete Glass Construction Company has been incorporated in New York State by C. J. Wood, White Plains, N. Y., with an estimated capital of $32,000.

The United States Glass Company's plant at Glassport, Pa., is reported to be turning out a considerably larger output of glassware than for some time past.

The Pittsburgh Plate Glass Company's reforested land at East Fultonham, O., was recently visited by F. W. Dean of Wooster, O., State Extension Forester, who found that the locust trees planted there some time ago when one foot high have grown to the height of from 12 to 15 feet.

Hazel-Atlas Glass Company, Wheeling, W. Va., according to the financial report submitted at the recent annual meeting, showed a net income for the year 1929 of $2,108,619.

The Michigan Alkali Company, General Sales Department, announces that beginning April 1, 1930, their new address will be 10 East 40th Street, telephone Ashland 9161.

Leeds & Northrup Company, Philadelphia, Pa., have moved their Cleveland, O., office from the 12th floor to larger quarters at 1941 Union Trust Building.

The Owens Illinois Glass Company of Oklahoma has been incorporated in Ohio with a capital of 250 shares of no par value.

Recent Publications

Motion Pictures and Illustrated Lectures.—General Electric Company, Schenectady, N. Y. A list of films intended for exhibition in the interest of education, commercial development and public welfare. For such purposes they are lent without charge except the cost of transportation to persons who will be responsible for any damage done to the films and for the cost of returning them to the company. The list includes a number of subjects relating more or less to glass. Among them are, Revelations by X-ray, Beyond the Microscope, Making Mazda Lamps. A large number of technical films are included. Illustrated lectures are listed on Incandescent Lamps (historical and manufacture), Lighting in Our Homes, Street Lighting, Lighting in Industry, Store and Show Window Lighting, Vacuum Tubes for Radio Communication, Searchlights, Aviation Lighting, Vacuum Tubes, the X-ray, Light and Lighting, Mazda Lamps.

Johns-Manville Celite for Concrete. A 28 page brochure, a revision and enlargement of a similar brochure issued last May. The new edition contains new material and photographs showing extensive applications of Celite in the construction of concrete structures of many types. The material is furnished in the form of a light weight powder in extremely divided form. No changes in equipment or methods of mixing and placing concrete are involved in its use. The amount of Celite which should be added per 94-pound bag of cement is given in a table on page 5. The use of this product is fully discussed and illustrations of industrial and mercantile concrete buildings, hospitals, churches, etc. in which Celite has been used successfully are given.

Ultraviolet Reflecting Power of Aluminum and Several Other Metals. Research Paper No. 141, Bureau of Standards, U. S. Department of Commerce, Washington, D. C. For sale by the Superintendent of Documents, Washington, D. C., price five cents. Data of special interest in connection with the use of aluminum in reflectors of therapeutic lamps. The results of the investigation show that the ultraviolet reflecting power of aluminum compares favorably with that of chromium. Data and diagrams relating to reflectivity of various metals.

Certification, Significance and Scope. Miscellaneous Publication No. 105, Bureau of Standards, U. S. Department of Commerce, Washington, D. C. Involves the compilation and distribution of lists of manufacturers desirous of obtaining contracts based upon certain selected nationally recognized specifications and willing, when requested to do so, to certify to the purchaser that the commodities delivered are guaranteed to comply with the requirements and tests of the specifications.

Time-O-Stat Controls Company, Elkhart, Ind. A 38-page 4⅝ by 7⅛-inch catalog, describing and illustrating the company's products, covering automatic controls including thermostats, electric control motors, oil burner control systems, gas valves, safety pilots, etc.

Causes of Compensated Accidents. Records of three years ended June 30, 1929. Special Bulletin No. 164, State of New York Department of Labor, Bureau of Statistics and Information.

Refractories Institute Annual Meeting

American Refractories Institute will hold its annual meeting at White Sulphur Springs, W. Va., on May 19 and 20.

Recent Deaths

John E. Hill, Jr.

John E. Hill, Jr., in charge of the Central Glass Works plant at Wheeling, W. Va. died March 12 at the age of 39.

What The World Wants

Specific inquiries for American Goods Received in the Department of Commerce, Washington, D. C.

Scotland—44069, Opalescent Glass.
Canada—44054, Glass vases, cheap, and glass spools or pedestals.
Chile—44090, Glasses and mirrors.
Scotland—44367, Glass for building construction.

Inquiries Received

For further information address THE GLASS INDUSTRY

488. (From Belgium) Please put me in touch with manufacturers of plate glass grinding and polishing machinery and equipment, and also of hydraulic presses suitable for use in the manufacture of laminated glass.

489. Please send me the titles, authors, addresses, and publishers of any books that will be instructive in laboratory glassblowing, etc.

490. Will you please send me the names and addresses of the different companies who manufacture reflecting glass such as is used for traffic signals.

491. (From England) Can you give us the name of the firm that manufactures the safety appliances for the protection of workmen as described in the article on organizing a safety system for a glass plant, in the January, 1930, issue?

READERS' WANTS AND OFFERS

FOURCAULT ENGINEER

DIPL. ENG.—Thirty-four years old, unmarried, German, with many years of experience in the manufacture of window glass, as well as the manufacture of fluted glass, rough and wire glass, thoroughly familiar with tank operation, gas economy and frit investigation, as well as tank construction and repair, practical knowledge of natural gas operation, long time abroad, perfect knowledge of English and French languages—

Seeks a position in an American glass works. Engagement from New York. Address F. S. c/o The GLASS INDUSTRY, 50 Church St., New York.

SALES ENGINEER

WANTED—Young man with manufacturing or engineering experience in the Glass Industry, to become Sales Engineer for long established manufacturer of recording instruments and automatic temperature controllers. Candidates preferred who have had both industrial experience and scientific education, and who are free to travel through the great industrial districts. Highest character references required. Write, stating experience, age and salary desired. Address Sales Engineer, c/o The Glass Industry, 50 Church St., New York.

BOTTLE PLANT OPERATOR

WANTED—Experienced bottle plant operator for South America. State age and experience in detail, also salary expected. Address 3A c/o THE GLASS INDUSTRY, 50 Church St., New York.

MERCHANDISE WANTED

Slow moving stock, close outs, job lots, quantity lots preferred. Will purchase outright or sell for your account. What have you to offer? Goss Trading & Sales Company, 60 Sunset Trail, Bronx, New York.

Current Prices of Glass-Making Materials

March 21, 1930

Quotations furnished by various producers, manufacturers and dealers.

		Carlots	Less Carlots
Acid			
Citric (dom.)	lb.	.46	.46
Hydrochloric (HCl) 20° tanks, per 100 lb		..	1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	..
Sulphuric (H_2SO_4) 66° tank cars	ton	15.50	..
Tartaric	lb.	..	.38
Alcohol, denatured	gal.	..	.52
Aluminum hydrate (Al (OH)$_3$)	lb.	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3)	lb	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.21-.22
Ammonia water (NH_4OH) 26° drums	lb.	.03	.03¼
Antimony, metallic (Sb)	lb.	..	.09¾
Antimony oxide (Sb_2O_3)	lb.	..	.105-.11
Antimony sulphide (Sb_2S_3)	lb.	..	.14
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.04	.05
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh	ton	47.00	..
90% through 100 mesh	ton	44.00	..
Barium hydrate (Ba(OH)$_2$)	lb.	..	.05-.05½
Barium mixture, glassmaker's, f.o.b. St. Louis	ton	25.00	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	.08¼	.08½
Barium selenite ($BaSeO_3$)	lb.	..	..
Barium sulphate, in bags	ton	..	..
Barium sulphate, glassmaker's, carlots, bulk, f.o.b. shipping point,	ton	15.00-16.00	18.00
Bone ash	carlots, lb.	.06	.06½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	..	.0355-.0425
Crystal	lb.	.028-.033	..
Granulated	lb.	.025-.03	..
Powdered	lb.	.02875-.03375	..
Boric acid (H_3BO_3)	lb.	.0625-.07125	.06-.08125
Refined	lb	.0625-.07125	.07125-.08125
Cadmium sulphide (CdS)—			
Red	lb.	..	.90-1.00
Orange	lb.	..	.90-1.10
Yellow	lb.	..	1.20-1.25
Chromium oxide (Cr_2O_3)	lb.	.24	.25
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	2.00-2.10
In 10 lb. tins	lb.	..	2.15-2.25
Copper oxide			
Red (Cu_2O)	lb.	..	.30
Black (CuO)	lb.	..	.28-.30
Black prepared	lb.	.	.30
Cryolite ($Na_3Al\ F_6$) Natural Greenland			
Kryolith)	lb.	.09	.10-.10½
Artificial or Chemical	lb	..	.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		..	1.15-1.20
Feldspar—			
100 mesh	ton	12.50-20.00	13.50-22.00
80 mesh	ton	11.00-11.75	14.50
40 mesh	ton	11.00	13.50
Fluorspar (CaF_2) domestic, ground, 95-98% (max SiO_2, 2½%)			
Bulk, carloads, f.o.b. mines	ton	32.50	..
In bags or barrels	ton	36.50	41.50
Formaldehyde	lb.	..	.08¾-.09¾
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.0450
Black (FeO)	lb.	.04½	..
Kaolin (f.o.b. mine)	ton	9.00	..
English, lump, f.o.b. New York	ton	14.50-25.00	24.50-30.00
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb.	.08	.0925
Litharge (PbO)	lb.	.07	.0825
Lime—			
Hydrated (Ca(OH)$_2$) (in paper sacks)	ton	10.50	..
Burnt (CaO) ground, in bulk	ton	7.00	..
Burnt, ground, in paper sacks	ton	9.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15-2.25	2.30-2.60
Limestone ($CaCO_3$)		2.00-2.50	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.06	.07
light (in bbls.)	lb.	..	.23
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.07
Manganese 85% (MnO_2)	lb.	.04	.04½
Nickel oxide (Ni_2O_3), black— for nickel content	lb.	..	.35
Nickel monoxide (NiO), green— for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	21.00	23.00-29.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.09	.09¾
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.06½	.07
Hydrated 80-85%	lb.	.05¾	.06
Potassium chromate (K_2CrO_4)	lb.	..	.23-.32
Potassium hydrate (KOH) (caustic potash)	lb.	.07½	.08
Potassium nitrate (KNO_3) (gran.)	lb.	..	.05⅞-.06
Potassium permanganate ($KMnO_4$)	lb.	.16	.16½
Powdered blue	lb.	..	.24-.26
Rochelle salts, bbls.	lb.	..	.22
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb.	..	1.80-1.90
Silver nitrate ($AgNO_3$) (100 oz.) per oz.		..	.30¾
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.22½	..
In barrels	Per 100 lb.	1.55-1.57½	1.90
In bags	Per 100 lb.	1.37½-1.40	1.72½
Spot orders.. .025 per 100 lbs. higher			
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07	.07½
Sodium hydrate (NaOH) (caustic soda) Solid	Per 100 lb.	2.95	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04½
95 per cent.	Per 100 lb.	2.16	2.30
Sodium selenite (Na_2SeO_3)	lb.	..	2.00
Sodium fluosilicate (Na_2SiF_6)	lb.	.05	.05½
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.50
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb.	.39	.37½
Tin oxide (SnO_2) in bbls.	lb.	..	.40
Uranium oxide (UO_2) (black, 96% U_3O_8)			
100 lb. lots. Black	lb.	..	2.75
Yellow	lb.	..	1.50
Zinc oxide (ZnO)	lb.	.08½	.12
American process, Bags	lb.	.06½	.07
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½-.08
Crude, Gran. (Milled .005-.02c higher)		.03½	.04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to February 24, 1930

	January 1929 Quantity	January 1929 Value	January 1930 Quantity	January 1930 Value	Six Months Ending December 1928 Quantity	Six Months Ending December 1928 Value	Six Months Ending December 1929 Quantity	Six Months Ending December 1929 Value
Glass and glass products (Total)	.....	$881,381	.....	$789,352	.....	$5,336,230	.....	$5,432,762
Plate and window glass—								
Window glass, common, box 50 sq. ft.	1,035	6,168	2,876	15,780	9,535	51,052	4,847	33,135
Plate glass, unsilvered, sq. ft.	207,559	74,116	178,334	65,551	1,164,835	341,119	888,452	340,584
Other window and plate glass lbs.	324,311	37,150	372,504	28,053	2,273,908	248,501	2,513,631	272,239
Glass containers (bottles, vials and jars)	.....	278,840	.....	246,147	.....	1,809,550	.....	1,830,981
Table glassware, plain	.....	106,427	.....	120,321	.....	733,697	.....	759,771
Table and other glassware, cut or engraved	.....	7,920	.....	8,192	.....	79,341	.....	73,737
Lamp chimneys and lantern globes lbs.	137,152	29,189	83,529	16,460	633,014	137,987	806,830	159,046
Globes and shades for lighting fixtures lbs.	189,448	59,048	136,164	52,151	1,003,702	341,301	1,028,430	364,137
Chemical glassware lbs.	18,200	18,718	23,089	22,279	129,711	111,895	171,171	141,198
Electrical glassware, except for lighting lbs.	757,016	50,042	514,938	37,628	2,252,539	225,091	1,405,896	141,467
Other glassware	.....	213,763	.....	176,790	.....	1,256,696	.....	1,316,467

IMPORTS

Corrected to February 24, 1930

Glass and glass products	.....	$1,122,481	.....	$861,918	.....	$8,477,684	.....	$7,287,051
Cylinder, crown and sheet—								
Unpolished, not bent, obscured, beveled, etc.—								
Weighing less than 80 pounds per case. dut. lb.	3,442,931	88,657	669,760	27,849	19,529,873	606,893	10,438,010	342,504
Weighing 80 pounds or over per case. dut. lb.	3,241,566	120,543	2,260,379	86,620	12,753,524	571,568	12,405,674	445,808
Polished and bent, obscured, beveled, colored, etc., unpolished and polished, and all silverd. dut.	.....	47,902	.....	43,947	.....	303,692	.....	234,388
Plate glass—								
Polished, unsilvered dut. sq. ft.	1,402,029	291,981	557,655	115,685	8,015,899	1,636,801	5,643,284	1,115,585
Other dut. sq. ft.	57,056	11,474	133,170	31,272	998,946	249,444	1,093,845	225,311
Bottles, vials, jars, demijohns and carboys, molded or pressed dut.	.....	29,351	.....	101,788	.....	144,573	.....	184,350
Table and kitchen utensils dut.	.....	16,855	.....	16,341	.....	165,643	.....	151,153
Glassware, cut or decorated dut.	.....	220,342	.....	167,145	.....	1,709,137	.....	1,842,498
Blown, glassware, n. e. s.—								
Bottles, ornaments, gauge glasses and other n. e. s. dut.	.....	66,922	.....	41,631	.....	1,420,159	.....	1,186,591
Bulbs for electric lamps dut. No. 1	2,146,584	17,496	1,704,801	15,038	9,277,161	109,248	6,567,388	63,888
Chimneys, globes, shades, prisms and other illuminating glassware dut.	.....	78,140	.....	57,240	.....	555,982	.....	351,064
Articles and utensils for chemical, scientific, and experimental purposes dut.	.....	40,974	.....	51,026	.....	281,636	.....	351,955
Other glassware dut.	.....	91,844	.....	106,336	.....	722,908	.....	791,956